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IN a recent issue we devoted considerable space to a review of the condition of electrical applications and enterprises in the West. This week we are paying special attention to the East, and it may fairly be said that our pages give a very full and complete idea of what is being done in that section in electrical development at the present time. Our New England representative, who has recently made a trip throughout his busy territory, presents in his letter a lively and highly interesting sketch of the work being done or in contemplation; and elsewhere in the paper will be found several articles on, and illustrations of, improvements and devices just brought out by manufacturing companies and supply houses in New England. All the signs that can be read indicate a sound condition of affairs electrically throughout the New England States as well as in New York, and so far from the period being one of abnormal activity, it is in our opinion simply preliminary to greater expansion and permanent welfare in every direction. Our columns contain, in addition to the large amount of special matter, the usual and copious variety of news and discussion, as well as a number of important contributed articles. It will be noticed that this issue consists of no fewer than 40 pages.

THE hotel papers are calling attention to the desirability of a more general adoption of electric fire-alarms in hotels. The recent experience at Buffalo, when an alarm by its timely warning helped to save a great many persons, ought to be enough to convince any one that some such apparatus is a necessary adjunct of every well-conducted hotel, and we trust there will be a general adoption of apparatus of this character.

THERE never was a time when the electric light industry was in better shape than it is to-day. The various lighting systems have already been carried to a high degree of excellence, and the natural result is that the demand for the light is brisker and brisker. At this season of the year there is generally a slackening of output, but just now redoubled effort has to be made by the parent companies to meet the constant calls for machines and lamps, and already the new department of electric power is requiring and receiving close attention. Last week, for example, even with close condensation, our two departments of "Electric Light," and "Applications of Power," filled about a page. This week again they take nearly as much. If this were the beginning of the Fall season, it would not be particularly remarkable, but coming as it does at the opening of Spring, when such work generally experiences a lull, the exhibit is nothing short of phenomenal.

NOTWITHSTANDING the well grounded belief in the present theory of electricity as a mode of motion, like heat, light, etc., there seems still to be a lurking of doubt even among scientists as to the extent to which that theory applies to electricity. In an article appearing in our last issue, Mr. Carl Hering advanced certain queries with regard to this subject, in which, without bringing forward any dogma, he suggested that future research might show that a current of electricity is the bodily conveyance of ether as distinguished from wave motion, which is light. Prof. Dolbear in this issue takes up the discussion and points out that the terms "force" and "matter," as used by Mr. Hering, are somewhat ambiguous. He shows that the "vortex theory" of matter may be applied to the case, in which instance ether and energy are the factors involved. Prof. Dolbear's method of demonstrating by mechanical means the apparent dual action of electricity is also very apt, and may assist teachers in trying to explain to their pupils the nature of electricity.

THE question asked by a correspondent and answered in another column may serve as a good text to remind the searcher for improvement that a certain amount of energy expended can only perform an equivalent amount of work and no more. Our correspondent has evidently had the same idea that has occurred to a good many, and has, we believe, already been tried, viz., that if a number of groups of lamps were fed from a supply of current rapidly distributed to each in succession, each group would tide over the break, and thus the light-giving value of the current could be greatly increased. Such, evidently, cannot be the case, for, as is shown, the working potential at the lamp is the mean of the various potentials existing during a given interval, and not the maximum at any one instant. We have quite an analogous case in the operation of lamps with alternating currents. Although our measuring instruments indicate a certain potential, there can be little doubt that the maximum E. M. F. at one instant of the alternation is twice that indicated by the instrument—and at another instant it is zero. The mean of these two is the working E. M. F. The law of the conservation of energy applies here as in every other instance. There may be instances in electrical work where this law may appear at times not to hold entirely good, especially when self-inductive effects are present; but such effects change nothing in the law, and do not render it inaccurate.

THOUGH the incandescent lamp has obtained a decided foothold on arc circuits in this country, the application of the arc lamp to the incandescent circuit is still in its infancy. There can be little doubt, however, that in many instances the placing of an arc lamp on such circuits would be advantageous, as has been found in the former case. But the point usually considered is that the arc light, as ordinarily constructed, is too powerful except for the illumination of out-door spaces or very large halls or apartments. The small—200 or 300 c. p.—arc lamp seems still to be a thing of the future. There is no reason, however, why, if the large lamp be successful, a smaller one cannot be constructed which would be suited to lighting larger areas. For ordinary use the incandescent lamp, of course, cannot be improved upon as a method of illumination; but there are cases in which an arc lamp of from 100 to 200 candle-power might find application. In another portion of this issue will be found an article dealing with an arc lamp which, by all accounts, is working very satisfactorily on the incandescent circuits, and which, therefore, has its deserved place in electric lighting economy.

WHILE the coining of electrical terms still continues, the origin of some words already in use a long time has become a matter for dispute. Thus in a recent article appearing in an American contemporary, Mr. T. D. Lockwood traced the origin of the word "telephone" as far back as 1845 in connection with the invention of a certain Captain Taylor, and he stated that although the earlier experiments of Prof. Wheatstone were far more intimately connected with the modern developments of telephony than those of Capt. Taylor, the term did not appear to have suggested itself to Wheatstone. This statement is taken exception to by a correspondent of an English contemporary, who draws attention to the following extract written by Prof. Wheatstone in 1840, and appearing in the *Lives of the Electricians*: "When, in 1823, I made my important discovery that sounds of all kinds might be transmitted perfectly and powerfully through solid wires, and reproduced in distant places, I thought I had the most efficient and economical means of establishing telegraphic (*or rather telephonic*) communication between two remote points that could be thought of. My ideas respecting establishing a communication of this kind between London and Edinburgh you will find in *Journal of the Royal Institution* for 1831." The writer goes on to say that as Wheatstone is accredited with having first used the word "microphone" in 1827, it is scarcely credible that he was then ignorant of the word "telephone," but he was sparing in his use of new or technical words. In connection with this subject of electrical nomenclature, the new suggestions for the naming of the air-space in the dynamo, which appear in another column, will be interesting if not instructive. The point is one that evidently engages the attention of a great many persons, as it is rarely that so many communications are elicited on any single subject.

AS compared with Europe, this country has shown a remarkable development of isolated electric lighting plants. The difference between the two has often called forth comment, and a favorite explanation has been the lack of enterprise on the part of Europeans. This opinion is not, however, well founded. The well-known conservatism of the average citizen of Europe may account for the existing state of affairs in a measure, but there are other causes affecting the industry very directly. Chief among these, for example, is the fact that in Europe the rules and regulations regarding the placing of steam boilers are excessively stringent. We are accustomed to place boilers in cellars, under sidewalks, or wherever it is found most convenient, but such a proceeding would not for a moment be countenanced in most European countries. In some of the latter, nothing more than a two-inch plank is allowed to be placed over a steam boiler. There seems to be a strange idea in the Old World that a boiler on exploding rises in the air and falls exactly in the same spot, and that if there is anything in the way to prevent this intelligent action on the part of the bursting boiler, much damage may be done. In consequence of this "superstition," boilers must be placed in separate buildings, and thus valuable space is required for steam plants. Hence it is that the gas-engine has come into extensive use abroad in conection with isolated plants. In proof of the difficulty encountered in the installation of a boiler in connection with electric lighting, we were recently informed by a foreign gentleman that it took two years of hard work to obtain permission to erect the necessary power plant in a certain place. Under such conditions, evidently, electric lighting must languish. Of this trouble in an extreme form, example was given lately with the Gordon installation at Paddington, which, according to American notions, is well placed, but which, according to the average European idea, is an improvement not to be endured. America is certainly to be preferred.

On the Nature of Electricity.

BY PROF. A. E. DOLBEAR.

The article by Mr. C. Hering in the last number of THE ELECTRICAL WORLD calls for a remark or two upon his use of terms, and upon his fundamental assumption that force and matter underlie all physical phenomena.

As to force, it is pretty generally agreed that it has no objective existence, and the word is used in so many senses that physicists are abandoning its use save for certain and definite conceptions, as, for instance, *the rate of change of momentum*. But a rate of change was not what Mr. Hering had in mind, evidently, but what is better expressed by the word *energy*. This would make his statement to read that matter and energy underlie all physical phenomena. Now, the term *matter* has a certain definite meaning in physical science which would be quite destroyed if Mr. Hering's use of the term should be allowed.

Recall the terms of the law of gravitation. "*Every* particle of matter in the universe attracts every other particle," etc. If there be any kind of *matter* in the universe that does not possess this property of gravitation, then the law should read, "*Some* particles of matter in the universe," etc., which would degrade the law from its universality to a very indefinite expression. By matter is understood the so-called elements and their compounds —what possesses *mass*.

Formerly heat, light, electricity, and so forth, were called immaterial, which was not so objectionable, but to speak of immaterial matter could hardly be tolerated.

It is pretty well agreed also that there is in the universe what, for a name, we call the ether, which is neither force nor energy nor matter; perhaps it may be called a substance, if one wants a generic name for it. If, then, one wishes to specify the fundamental conditions for the physical phenomena of the universe, he might say that energy, ether and matter were the objective conditions; but if one gives credence to the vortex ring theory of matter, and that view is daily becoming more credible, then the fundamental conditions will be reduced to two, namely, ether and energy, for the atom of matter is but a *form of energy of* ether *in* ether; that is to say, that what constitutes the atom is its specific kind of motion, a vortical motion, embodying energy, so that if in any way an atom could be destroyed it would be resolved into ether, and its motion would be dissipated, as is the case with the smoke ring of a locomotive into the air in which it was formed.

But there are numerous reasons that may be brought for giving another interpretation to the character of electricity than Mr. Hering has given. One is that electricity never appears except when matter (as defined) is present and energy is spent upon it. Now the expression for energy is $\frac{m v^2}{2}$, where, for a given mechanism of any sort, the only variable would be v, a velocity that is a rate of motion. Now the form in which energy appears depends upon the character of the motion involved. For instance, what we call heat is vibratory molecular motion, and the temperature of a body varies as the square of the amplitude of such molecular vibrations, and as heat is easily changed into electricity, it would seem to follow that there was simply a change in the character of the molecular motions. The difficulty hitherto in getting a mechanical idea of electricity has been from its apparently dual character, which we recognize as positive and negative, plus and minus. For a number of years I have used the following mechanical device for its electrical analogy. Take a rope ten or twelve feet long and bring its ends together in the hands, now commence to twist the rope and observe the advancement of the twist. Toward the right, if the twist be in the direction of the hands of a clock, the advancing motion will be seen to be traceable to the left hand, throughout the circuit; at the same time the motions traced from the left hand will be exactly opposite in direction, and traceable to the right hand through the circuit, so that there is as much motion in one part as in any other part of the circuit, and yet both motions are co-existent, nowhere interfere with each other, and are right-handed or left-handed, according to the position of observation. Let the energy of the hands in twisting the rope be likened to the chemical energy, say, in a battery, and the analogy is very close between the mechanical and the electrical circuit. If we call the right-handed motion positive and the left-handed negative, the mechanical terminology will be the same as the electrical.

Automatic Switches for Storage Batteries.

Various forms of automatic switches, designed to prevent the reversal of series or compound-wound dynamos when used for charging secondary batteries, are already in use. The Kent switch, illustrated in Fig. 1, is one of the most simple that has come under notice, says the London *Electrician*, and in delicacy and certainty of action leaves nothing to be desired. In the figure *B* is a coil of low resistance, provided with a soft iron core, and connected as a shunt upon the terminals of the dynamo. The polarity of this magnet is therefore independent of the direction of the current in the main circuit. A soft iron armature pivoted at or near its centre, has wound upon it the thick wire coil *A*, which is placed in the main circuit, the connections being made through mercury cups. This armature carries a stout copper wire, which dips into two mercury cups *C*, and makes or breaks the main circuit at this point. The connections of the large wire coil are such that the armature is held down as long as the current in the main is in the right direction; but if the battery overpowers the dynamo, the polarity of the armature is reversed, and the main circuit is instantly broken. A sliding

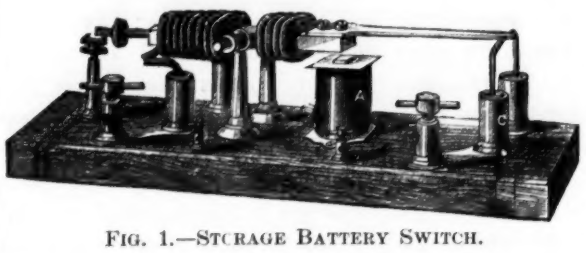


FIG. 1.—STORAGE BATTERY SWITCH.

weight regulates the delicacy of the action, and the range of motion is limited by the stop on the left hand, which is adjustable in the vertical direction. The switch closes the circuit at any desired potential, as well as breaking it in case of reversal.

A correspondent of the same journal has described a switch which also possesses some novelty and the following characteristics:

1st. It goes into action when the dynamo starts, and when the E. M. F. exceeds that of the battery.

2d. It breaks contact before the E. M. F. falls below that of the battery.

3d. It cuts out three or more cells from the lamp circuit while the dynamo is running, and restores them when it

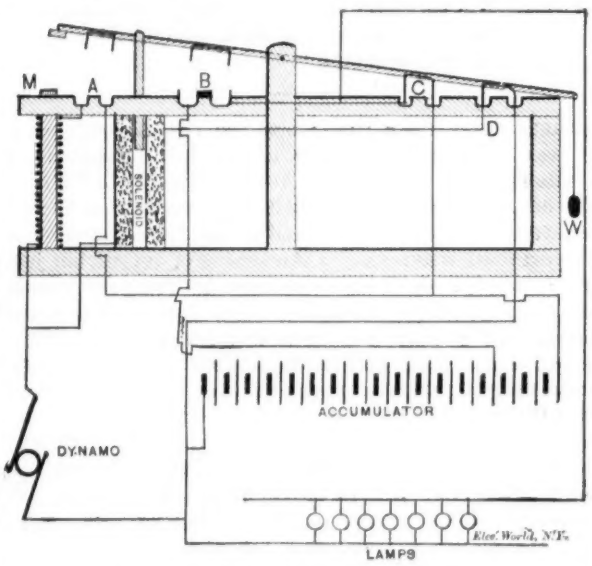


FIG. 2.—STORAGE BATTERY SWITCH.

stops, and thus keeps the lamps practically the same during charge and discharge.

4th. There is no waste of current through any shunt coils.

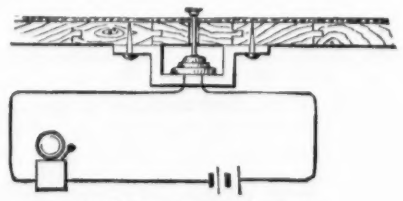
The sketch shows the position of switch when the dynamo is not running. When the dynamo starts, the solenoid draws down the rocking lever. This action puts the magnet *M* and accumulator into circuit through mercury cup *A*, at the same time cutting out the solenoid. When cups *C* are connected, the whole 30 cells are on the lamps; when cups *B* are connected, only 27 cells. The weight *W* is adjusted so that the solenoid will not pull the lever down until the E. M. F. is above that of the battery.

The gates of the turbine driving the dynamo are automatically shut, and the wheel is thus stopped by a cord and weight attached to the lever and rack of the gates. A trigger held up by a small electro-magnet in the main circuit at the house allows this weight to act and stop the turbine.

A Floor Push-Button.

BY M. M. WOOD.

The accompanying sketch represents a cheap but practical floor push-button adapted for use in the dining room to



A FLOOR PUSH BUTTON.

signal to the kitchen and where an attachment of wires to the table would not be permissible on account of the movement of the latter. The push shown can be placed in any room without removing the carpet or cutting away any part of the floor. Its manner of attachment is apparent. It should be remarked, however, that the push-button must be concave, which style can readily be procured from dealers in electrical goods, in order that the pin projecting through the floor may have a permanent and solid bearing.

The Extreme Importance of Attention to Little Things in Telephony.

BY THOMAS D. LOCKWOOD.

Part 1.—Details of Management.

I have long been promising myself the honor of writing an article for THE ELECTRICAL WORLD upon the above subject, but its magnitude has continually loomed up before me in a portentous style and has rather appalled me. I have, however, at length nerved my courage to the sticking place, and though the title I have prefixed to the paper may seem rather inappropriate, I intend to try to do justice to the subject.

Perhaps a more correct title would be—"The total depravity of *inattention* to little things."

Nor do I propose to illustrate and specify *all* the little things which in the applications of electricity are neglected or done badly, and inasmuch as I am more at home in the realm of telephony than in any other branch of applied electricity, I purpose on the plea that "charity begins at home," to devote my attention chiefly to that branch; and if I do occasionally stray over the line, it must be excused under the counter plea—"it should not end there."

Throughout the United States there exists, in all walks of life, and in nearly all trades and professions, a tendency (often resisted, it is true) to ignore means and look to the end only. The result is that the means are unintentionally neglected, notwithstanding the uncontrovertible fact that close attention to their every detail will insure not only a more perfect achievement, but also a more economical achievement of the end.

And among subordinates especially there is also a disposition, only to be eradicated by close and efficient supervision, and continual, patient and reiterated instruction, to slur work, and to do things *not* as well as they know how. This arises partly from carelessness; partly, I think, in some cases, from a fear that if a thing is *too* well done, by-and-by all the work will be exhausted, and that their services will be no longer required, or that if they are, they will at least be lightly esteemed; and partly also from a vague feeling on the part of employés that it isn't worth while to take the pains essential to do good work; that if they do, it will in any event not be appreciated; and that as they are not in a position to bring the character of the work they do directly within the knowledge and supervision of the superior officers of their employers, it is not necessary to show their best work merely for heads of departments, who will take credit for all the good there is in it, but who will take great care to unsparingly blame them for any small mistake.

I would not be understood as bringing a sweeping charge against the rank and file of electrical service. On the contrary, I fully believe, and am glad to believe, that the great majority are men quick to perceive their whole duty, and quick to do it, to do it well, and ambitious to rise, and to rise because they have deserved it. And I do not desire it to be understood that I blame any, except those who, despite instruction, practically refuse to do what they have to do as well as they can.

I would that every man, boy, woman or girl engaged in the practice of any electrical vocation, and particularly in telephony, would aspire to reach the highest positions open to them; not through favoritism or personal attractions, but simply by doing the work that is assigned to them just as perfectly and efficiently as it can possibly be done; and by striving constantly to make themselves fit for work of a higher class.

There can be nothing more sure than this: that sooner or later those who establish for themselves such a *rule* will sooner or later establish for themselves a *reputation* for doing things well, which is to them "capital;" and it is equally sure that to them sooner or later will come the call to higher and more responsible position.

Not the least part of efficient work is the will and power of looking out for small things, and of paying attention to detail. It is those who do this that win in the race of life; and it is equally certain that those who "despise the day of small things" will fail.

The wise king, in his wisdom, said: "Take us the foxes, the *little foxes* that spoil the vines," and although he hardly applied his own wisdom to his own life, I think he perhaps pointed the moral better than if he had.

Throughout history the rule holds good, that he who keeps a bright lookout to improve the opportunities that come in his way, and who does the smallest things that fall to his share absolutely as well as he can is the one who makes the footprint on the sands of time. "For he who is faithful in little is faithful also in much."

Take the root and groundwork of telephonic service—line construction—how strong the temptation where a close scrutiny is not kept of digging four-foot pole holes where they ought to be five feet, and three feet where they ought to be four! Or of leaving a whole line with unsoldered joints because it is troublesome to solder them, even though soldering pot, blow-pipe and iron are provided, and though iron-clad rules are made that they must be used! Or if the line is well built with joints duly soldered, one man happens to be alone and six o'clock arrives; there is one more joint to make; if he makes it without solder he can finish the job and pack up his tools by three seconds before six; but if he does what is right

and solders the joint, it will take him until two minutes and thirty seconds after six—it is a question with him which line of conduct he will take. This is a crucial test. The average man will say, "Well, I'll let this go, I guess, and solder it the next time I come along." The man below the average will say, "I guess I'll skip this joint; *one* unsoldered joint can't do any harm;" and the man who is above the average and who will presently astonish the others by being put over their heads, will say, "A few minutes won't signify to me. This job has got to be done well, or it won't suit me, and so here goes;" and he will do it, no matter how long it takes him.

For the first man, who really meant to come back to-morrow, never learns that a to-morrow of that kind never comes; a more important job is on hand, and in the course of a few days the cares of the lines and the deceitfulness of the weather conspire to make him forget all about it. It does not occur to him again until a resistance of 13,999 ohms develops in that joint and a few claims for rebate come in, costing more than a week's time of our recalcitrant constructor. The lesson here is not only "Do your work in a proper way," but also, "Do it at the proper time."

It is only fair to the construction force to say that too many telephone employers don't make any rules about soldering; don't provide any tools for that purpose; care nothing, and apparently know less, about the necessity of making first-class joints, and the disastrous results which accrue from the neglect of such work. This can, however, I hope, only be the case with such organizations as have not yet learned the lesson, that if they would be successful in a financial way, they must not only keep a careful watch to prevent useless and foolish expenditure, but must also be as careful to make judicious expenditure. In other words, they must totally abandon the penny-wise-pound-foolish policy. They must be willing to pay a good price for a good man, and must arrange to provide not only good men to superintend their different departments, but men who are adapted for their positions. Other things being equal, there is no chief equal to him who has grown by positive merit, and who has risen from the ranks in his own department. He it is who knows the necessity of attention to the small things, and who will be more likely to look after them. And not only

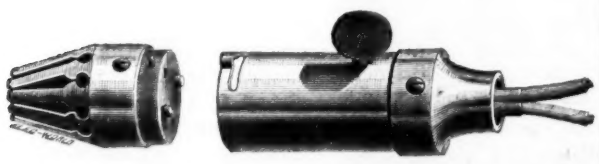


FIG. 1.—NEW INCANDESCENT LAMP SWITCH.

should executive officers appoint such men, but they should also give due heed to their counsel, wishes and advice; not, of course, in all cases yielding thereto, but always giving their views the most serious consideration.

I cannot but think it an advantage to any telephone company to have on their executive committee a thoroughly practical electrician, enabled to judge from his own experience the recommendations of departmental heads, and to wisely guide the deliberations of his associates in acting upon them. If this were more usually the case, we should hear much less frequently of the special little fox I am now about to refer to.

This is a little fox, to be guarded against by the higher officers of companies; it is a reluctance to supply their best men with proper appliances to determine the conditions of work, while they have apparently no hesitation in appropriating thousands to ill-considered and worse-planned construction. I have known companies refuse to purchase for their perfectly competent electricians a hundred and twenty-five dollar galvanometer; and promptly proceed to authorize the building of lines under conditions which to say the least were doubtful. Millions for construction, but not a cent for intelligent maintenance, or for practical pre-consideration.

I believe that this fox is being gradually exterminated, but he still exists in a "sporadic state," and ought to be hunted to the death. The time has come when a capable electrician (not one of the eight dollar a week kind) should be a regular member of the staff of every telephone company, and when no line under new conditions should ever be begun before he, having first-class instruments of measurement at his disposal, can at least say that he believes that line can be economically worked, and if not, why not.

Another Problem in Resistance.

BY CARL HERING.

The following problem which occasionally occurs in practice may be of interest to some of your readers. Two cells having different E. M. F.'s are connected in multiple arc and discharge through a common resistance. When this resistance is infinitely great the cell having the higher E. M. F. will evidently reverse the current in the weaker cell and discharge through it. When this resistance is zero both cells will discharge through it; hence there must be some value for the external resistance for which the current in the weaker cell is zero although it is connected to the circuit while the other cell is discharging.

The problem is to find the value of this resistance, and also the current which will flow in the external circuit as well as in each cell in a common short circuit; also the current circulating through the cells when the external circuit is infinite, that is, open.

The most frequent occurrence of this problem is in an ordinary armature in which the two parts are in multiple arc, but have not always the same electromotive force, as, for instance, when the field is unbalanced.

Let E and E' be the two E. M. F's., R and R' the internal resistances, and C and C' the two currents in the two cells, respectively. Let the external resistance be W and the current in the external circuit A. The resistances of all the connecting wires are supposed to be zero.

New Electric Light Fittings.

The accompanying illustrations represent some new fittings recently designed by Mr. Hochhausen, of the Excelsior Electric Company, for use in connection with in-

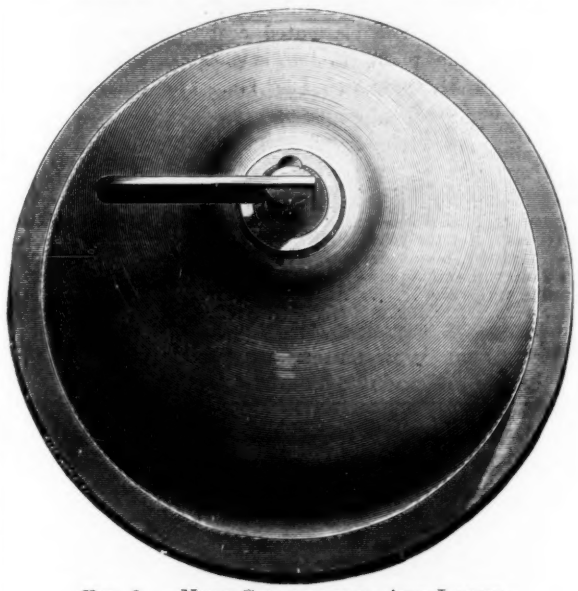


FIG. 2.—NEW CUT-OUT FOR ARC LAMPS.

candescent and arc lighting. The engraving, Fig. 1, shows a new incandescent switch and socket, which is so designed that the placing of the lamps in the switch establishes the required contact. The switch is arranged so as to give a quick break.

The cut-out, shown in Fig. 2 and in Fig. 3, with the cover removed, is designed so as to make a quick break independently of the slowness with which the operating lever is turned. The line wire is connected respectively to one of the two large sectors and one of the small ones, while the lamp is connected to the two remaining ones A spring attached to the shifting lever is so arranged that the contacts remain stationary until a certain angle has

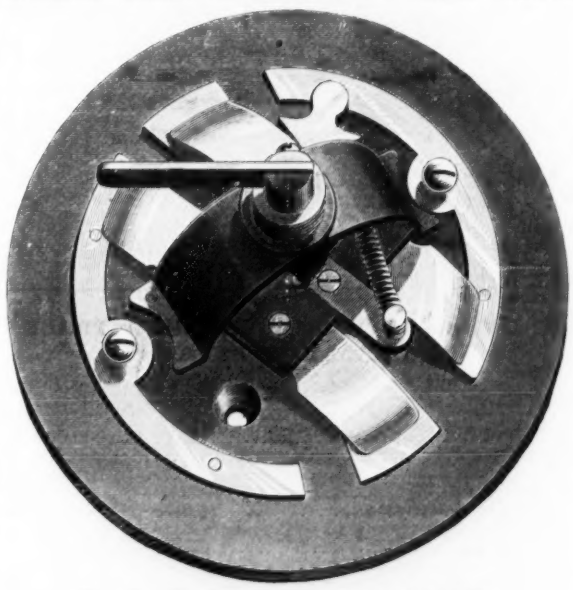


FIG. 3.—NEW CUT-OUT FOR ARC LAMPS.

been traversed, when the tension of the spring pulls the contacts over with a rapid motion. To avoid all danger of fire the whole arrangement is mounted on a base of slate.

The engraving Fig. 4, represents a suspension device for the double lamp. The two carbon tubes are surrounded by the two large clamp collars on to each of which an eye is cast, the latter serving as guide for the wire. The two hooks, held apart by a spring, pass up through an aperture in the centre of the hanger board, and are firmly embedded in the wood so that no motion can take place.

Efficiency of Electric Motors.

Mr. W. Hochhausen, of the Excelsior Electric Company, furnishes us the following copy of a letter he has addressed to the London *Electrical Review*:

In your issue of April 8 appears an article on a small motor, to the criticism of which I beg leave to make a few objections. Notwithstanding that it is stated in the first two lines of said publication, that the motor is intended for use on arc light or constant current circuit, the writer, in his subsequent utterances, seems to have constant potential circuits in his mind. That shunt-wound motors will regulate themselves on such circuits, I happen to know. Still I am thankful to the writer for reminding me of the fact. When it is asked what meaning the term "full speed" possesses, where the article, as copied from the New York ELECTRICAL WORLD, speaks of the efficiency of the motor, I must confess that a typographical error has caused obscurity,—read "full load." As the diameter of the armature is but four and one-quarter inches, the speed of two thousand revolutions per minute can hardly be called excessive. I indorse the statement that a motor, capable of developing three horse-power, can be made weighing but (125) one hundred and twenty-five pounds. The last question, what became of the E. M. F. at the terminals, which was 223.8 volts when the motor gave three horse-power, can be answered by the statement that the E. M. F. for obvious reasons does not exist any longer after the field coils are cut out.

One word more. If you would have the kindness to inform me who runs shunt-wound motors efficiently and with self regulation on arc-light circuits, in series with such lights, or other current consuming devices, and also where such motors could be seen, I would deem it a great favor.

On the Reversibility of the Induction Coil.

BY L. O. M'PHERSON.

The article by Mr. M. A. Tanner in THE ELECTRICAL WORLD, April 23, needs an additional chapter under the above caption, "to complete the history." April 14, 1868, there was granted to Elisha Gray a patent for a self-adjusting telegraph relay, the method of operation of which depended upon this reversible action of the induction coil. Briefly, his device consisted of two common Morse relay magnets of comparatively high resistance, described as being wound for "intensity currents," with their unlike poles facing each other, and connecting the N of each to the S of the other were two bars of soft iron wound with coarse wire "for quantity currents." The "intensity magnets" were coupled either in series or multiple in the main line

FIG. 4.—NEW ARC LAMP HANGER DEVICE.

circuit, and the coarse wire terminals with a polarized relay, whose coils were of coarse wire. This is only one of several forms given the induction coil by Mr. Gray, but in all those manufactured for use the central idea was carried out, *i. e.*, the reduction of the potential through the medium of the coil, which he had found by experiment to give the best results.

Many experiments were made by Mr. Gray, then of Gray & Barton, Cleveland, O., who manufactured the completed instrument, to determine the best method of securing the transformation; and there now exists in Oberlin College a coil, or coils, used by Prof. Gray in those experiments, consisting of a large flat coil of fine wire and another of similar external dimensions but consisting of a single copper ribbon wound up like a watch spring, but with insulation separating the turns. The professor accomplished conversion and reconversion of the current, as described in the patent of Deprez & Carpentier, quoted by Mr. Tanner, and the subject was common talk among telegraph and electrical people at that time.

Of course this does not apply directly to the distribution of light and power, but is nevertheless about the first practical use to which the reversible action of the induction coil was put, and I believe the patent referred to is the first one mentioning the foregoing action.

Batteries for Induction Coil and Small Lamps.

To the Editor of The Electrical World:

SIR: I wish to obtain some information in regard to an induction coil as follows: How much battery is required for a coil giving an inch spark? Will it light an incandescent lamp? If so, of what candle power?

HOGGS, Pa. AMATEUR.

ANSWER.—Your question is not clear. We presume you refer to what is termed an inch spark coil. If required to run steadily, it would take about 4 Grenet cells with freshly prepared liquid, or 4 Bunsens; the surface of the zincs should be about 12 to 16 square inches per cell, counting both sides. Four "quart Grenets" would probably answer. Less than this may be used provided the cells are not run constantly. Such a battery would have about 6 to 7 volts difference of potential, and will run 3 to 4 small incandescent lamps of that voltage, giving about 2 to 3 candles each. This, however, will depend greatly on the degree of incandescence to which the lamp is run; if run very brightly, it will give more light for the same current and potential, as the efficiency of the lamp is then greater, but its life will be considerably less.—EDS. E. W.

The Enos Elevated Electric Railway System.

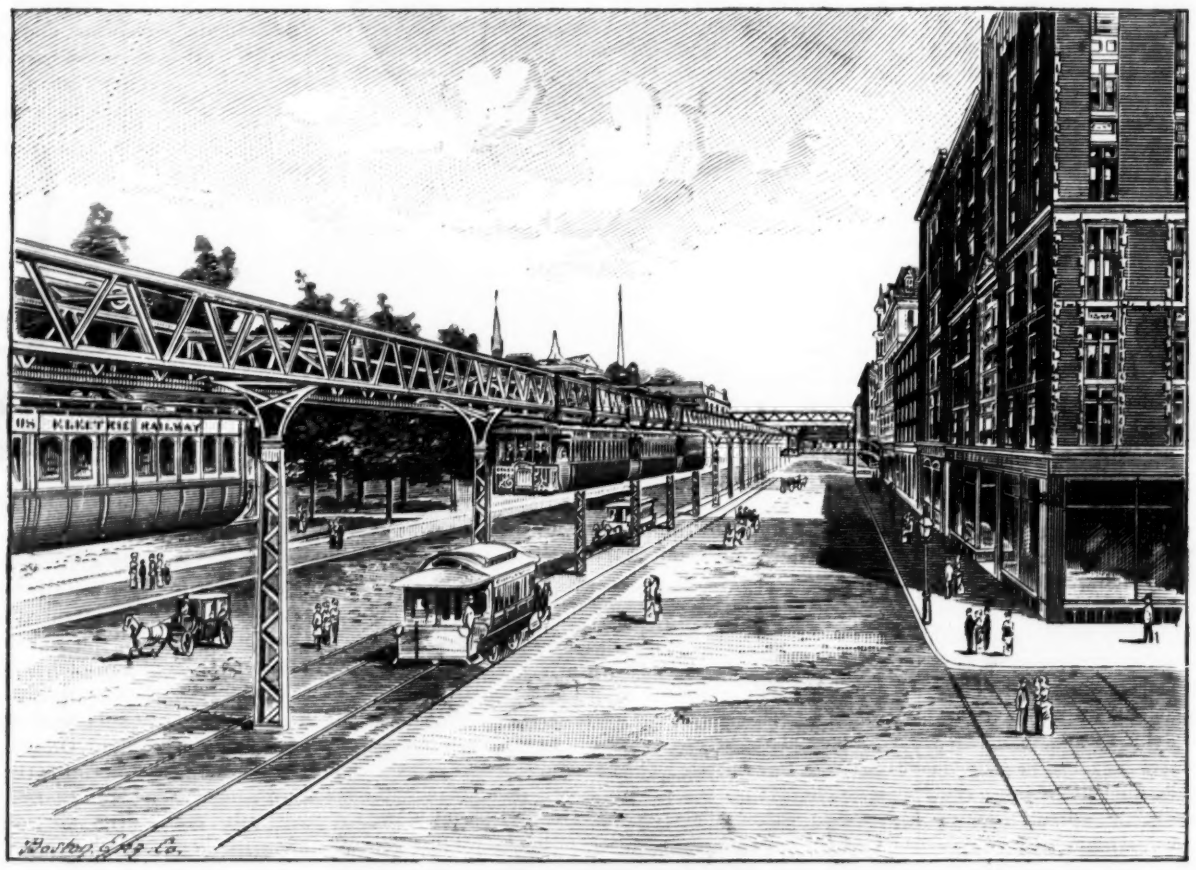
From time to time mention has been made in these columns of the Enos electric railway system, the peculiarity of which is that the running gear of the cars is placed overhead, the cars being suspended under the track, which consists simply of a single line of truss work. This system, invented by Mr. Enos, and now being introduced by the Enos Electric Railway Company, of Boston, was tried not long since at the works of the Daft Electric Light Company, Greenville, N. J., where a car operated by a Daft motor was run on a section of track. The system has been adopted for use at Los Angeles, Cal., and efforts are now being made to obtain permission for its use in Boston.

The accompanying illustration gives a fairly good idea of the method of constructing the line and suspending the cars. As here shown, the car is 14 feet above the ground, and therefore clears everything but exceptional obstacles. The truss is open and light, and there is necessarily an absence of wooden guard timber, cross-tie bars, sleepers, etc., which go to render the structure heavy and make the street below dark and gloomy. The current is carried to the motor by the rails, on the upper trestle, while the guide tracks or brake-wheels follow the under trestle. As will be observed, the whole electrical apparatus, being above everything else, is far beyond possible reach of the passengers or operatives, all that is required being the protection of the motor from the elements. The track shown in the cut is supported by a post similar to those now in use on the New York elevated roads, but all that is above it and on it is a strong lateral bracing and a light truss span. It is evident that with such a road, the cars as well as the track structure can be considerably diminished in weight; and it will also be clear that to derail a car would be an exceed ngly difficult, if not impossible, thing to do.

Until the system is given a thoroughly practical test, it would not be fitting to pronounce very emphatically upon its merits. It may be said, however, that at Greenville, 1,000 feet of track, with a curve of 60 feet radius and a grade of 400 feet to the mile, was put in operation with a full sized car capable of carrying 60 passengers. We were among the passengers, and found the motion the easiest we have ever experienced in car riding.

At the general offices, No. 2 Pemberton Square, is the model room, in charge of Mr. Geo. A. Johnson, the electrician of the company. The room contains a very beautiful working model, one-fifth size street car, on the Enos system, for the inspection of any one that may desire to see it. It runs upon a circular track fifteen feet in diameter. The current is furnished from the Daft power station. The rails are used as the circuit, conductivity at joints being assured by established methods. The top rail is insulated by a proper device for that purpose. The lower rail is common with the whole structure. The current is taken up by driving wheels, thereby dispensing with all brushes or special pulleys for that purpose. Hangers are insulated midway, the upper parts of motor frame being charged from the top rail, the return contact being through the guide wheels or lower trucks. The attention of the visitor is called to the simplicity of the moving parts in all its detail. As Mr. Johnson expresses it, "There is no more mechanism in the hanger than to a barn door," and the device certainly seems simple, with its pulley shafts elongated on both ends, the armatures placed upon them, the pulleys keyed to the shaft, the four separate fields forming four independent motors (two on each shaft) that can be worked together, or separate, should an accident happen to one or more of them at any time. There is, in short, a direct application of power, doing away with all gears, belts, endless chains or other parts of that nature.

The model can be made to perform all the movements that would ever be required of a full-sized car. The car is also lighted by the current that moves it. Mr. Johnson has devised for use upon this railway an automatic crossing signal that will at all times announce the approach of trains at crossings or stations by ringing a bell by day, and in addition to said alarm showing an incandescent light at night. The system seems eminently adapted for overhead transit in cities with narrow streets.



METHOD OF SUSPENDING CARS FROM OVERHEAD TRACK, ENOS ELECTRIC RAILROAD SYSTEM.

The Telephone in New England.

The report is appended of the New England Telephone and Telegraph Company for the past year. The gross figures are as follows:

	1886.	1885.	Decrease.
Gross earnings	$919,109	$920,841	$1,731
Expenses	659,695	697,014	37,328
Net earnings	259,413	223,816	*35,596

* Increase.

Dividends of $210,000 were paid during the year. There was expended for construction, $37,819; for reconstruction, $39,440; for repairs, $147,734; a total of $224,734. The mileage of exchange wires Dec. 31 was 12,303, an increase of 643 miles. Other statistics show: Exchange subscribers, 13,007; express, 518; private line and agency contracts, 2,680; total of subscribers Dec. 31, 1886, 16,205; total of subscribers Dec. 31, 1885, 15,526; increase, 679; extra-territorial lines, 79; miles of extra-territorial pole lines, 2,109; miles of extra-territorial wire, 3,092; number of regular employés of all classes, 478. The estimated cost of extending and maintaining the plant in 1887 is $260,000. The surplus account Dec. 31, 1886, was $369,178. The balance sheet upon that day was:

DEBTOR.

Licenses	$4,268,000.00
Plant	6,126,511.84
Unissued stock	1,605,400.00
Trustees	231,000.00
Construction (for the year 1886)	37,819.49
Office furniture, teams and tools	15,851.90
Bells, Material and supplies	125,635.58
Accounts receivable	87,450.07
Cash	68,909.63
Total	$12,566,578.51

CREDITOR.

Capital stock	$12,000,000.00
Surplus account	369,178.42
Income account	101,913.75
Reserve accounts	64,373.59
Bills and accounts payable	31,112.75
Total	$12,566,578.51

Net gain of exchange subscribers for the year 1886..... 590
Net gain of agency subscribers for the year 1886..... 89

A dividend of 75 cents per share is payable May 16.

Charging Secondary Batteries by Means of a Low Potential Magneto-Electrical Machine.*

BY F. J. SMITH.

It is sometimes inconvenient to set up a dynamo and engine of considerable size for charging secondary batteries. As the following method by which only a small machine and motor is used has answered well for several years, it may perhaps be of use to others who, like myself, are engaged in physical work. A small water motor drives a small magneto Gramme machine; the same motor by means of wheel work, for reducing velocity, switches the machine on to one cell of the battery at a time; such being the case, the E. M. F. of the charging machine need only be a little *in excess* of that of each cell. The method of charging in parallel was tried, but it did not answer well, as a slight difference of internal resistance of the cells caused the current to be unevenly distributed amongst them. A somewhat similar method of switching in cells by clock work has of late been introduced into the chlorine battery of Mr. Upward. The idea of putting the current on to one cell at a time seems to be due to Poggendorff (if I remember right), *Electrical Magazine* for 1842. It may be mentioned for the benefit of those who use chlorine gas, that it can be readily produced in abundance by the electrolysis of hydrochloric acid (carbon electrodes being used, as platinum is acted on by the gas as it comes off). A small motor and electric machine effects this constantly in the laboratory.

*London *Electrical Review*.

Winding Magnets.

To the Editor of The Electrical World:

SIR: Will you oblige an old reader of your valued paper by telling me the resistance of a wire $\frac{3.1416}{4}$ units long and one unit in diameter? It is used in the formula for filling a bobbin with wire of a given resistance. See "Monroe and Jamison's Pocket Book," p. 402, 3d ed.

$$d = -i + \sqrt{i^2 + \sqrt{\frac{K b (A^2 - a^2)}{R}}}$$

A = outer diameter of the bobbin.
a = inner diameter of the bobbin.
b = its length.
d = diameter of wire to fill it and produce a certain given resistance R, allowance being made for the radial thickness i of the insulation of the wire. K is the resistance of a wire $\frac{\pi}{4}$ units in length and 1 unit in diameter.

Please explain this. BURTON C. WILSON.
CHARLOTTE, N. C.

ANSWER.—This formula is a general one for determining the diameter of the bare wire, which will completely fill the space allowed for the coil or windings of a magnet or solenoid, and at the same time have a certain given resistance when wound.

The value of K, which depends only on the quality of the wire, may be calculated once for all for coils of copper wire. It is the resistance of a short, thick piece of copper of the dimensions given. If inches are used as the unit of length, as they probably would be in your case, this wire is $\frac{\pi}{4} = .7854$ inch long and 1 inch in diameter. Its value may be calculated from the following convenient formula:

$$R = 10.065 \frac{L}{D^2},$$

in which R is the resistance in legal ohms at 68 degrees Fahr.; L is the length of a wire in feet, and D its diameter in mils or thousandths of an inch. The constant, 10.065 which may in most cases be changed to 10, is determined from Matthiessen's standard. From this the value of K, when the sizes are in inches, will be .000000659. Care should be taken, in using the formula that you give, that all the dimensions are in the same units, say inches. Also, that the thickness of the insulation i is not confounded with the increase of the diameter due to insulation, the latter evidently being $2i$; this thickness should also be given in the same unit as the other dimensions. The formula you give is a convenient one for finding the proper size of wire for winding dynamo magnets, as it is always known what the dimensions of the coil space are, and what the resistance of the magnets may be; this resistance should always be assumed smaller than what it actually may be, in order to allow for a factor of safety; this is especially important for shunt machines. A further calculation should always be made to see that the wire does not heat too much. We have checked the formula and it appears to be correct.—EDS. E. W.

The Comforts of An "Apartment House."—"You must know that none of the occupants of this building are obliged to even send their letters out of doors for deposit in a lamp-post box," said the superintendent of a mastodonic apartment house recently. "There is a sluice in every room, the letters are dropped in, and as soon as there is a bit of an accumulation in the office we put it in the box at the corner, and that's all the trouble there is about it. Now," he continued, "what do you suppose that our next introduction is to be? Of course you can't guess. Well, we change a calendar in each suite every morning, regulate the clock by electricity, and, by Gemini, we are going to tell them how the wind blows by a little dial. There is a public weather dial, and it has been there for years, on the side of a building down in Burling slip. That will show you what I mean and pretty near how ours will be worked."—*New York Times.*

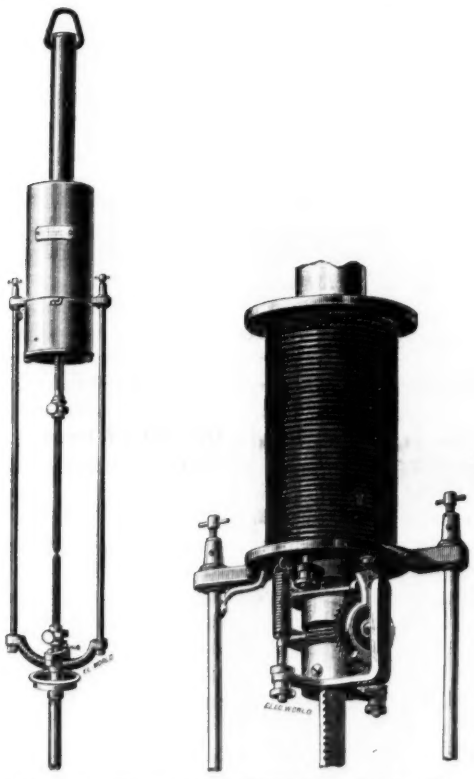
The "Simplex" Arc Lamp for Incandescent Circuits.

There are no doubt many situations in which an arc lamp can be profitably employed in connection with incandescent lighting, but the ordinary series lamp is as a rule not suitable to be placed on a circuit having a constant potential, being designed for constant current. Recognizing the value of a good arc lamp for incandescent circuits, the Simplex Electrical Company of this city and Boston have lately introduced the lamp shown in perspective in the accompanying engraving, Fig. 1.

The construction of the lamp is a very simple one and its operation extremely steady, as we have had occasion to witness. The regulating mechanism, which is shown enlarged in Fig. 2, consists essentially of a large bobbin of coarse wire within which is situated a hollow core of soft iron, the carbon holder passing through the centre of the core.

The carbon holder has a rack cut in its edge, which gears with a pinion held by a frame attached to the core of the coil. The speed of this pinion is regulated by a gravity escapement of the usual form. The core and its accessories have a play of about $\frac{1}{16}$ inch.

Now, when the lamp hangs vertically, without a current, the weight of the carbon rod is sufficient to actuate the gravity escapement and to allow the carbons to come together. When the current is switched on, the coil is energized, and the hollow core carrying the frame and pinion is raised. In so doing, however, the escapement lever, which has a small toothed segment at the top, comes in contact with a knife edge right under the base of the coil. The effect of this is, to prevent the pinion from turning and the carbon rod from descending. As the carbon burns away the resistance of the arc increases, the current in the coil diminishes, and the core and frame are allowed to descend.



FIGS. 1 AND 2.—THE SIMPLEX ARC LAMP.

But a descent of scarcely more than $\frac{1}{100}$ of an inch releases the escapement lever from the knife edge, and the carbon rod is then free to fall until it has decreased the resistance of the arc to its normal amount. When this state is reached, the coil is again sufficiently strong to attract the core, and brings the escapement lever in contact with the knife-edge stop, thus arresting the motion. The feed in this way is regulated with great sensibility and without a perceptible change in the brilliancy or steadiness of the light.

The general details of the lamp are also well worked out. The shade holder, which encircles a rod extending from the lower carbon holder, can be slipped down and clamped, so that new carbons can be inserted without removing the globe. The lower carbon holder also has a ball and socket joint for adjusting the carbon.

While in the form described, the lamp is adapted to be placed on incandescent circuits, the same principle of regulation is applied to a similar lamp designed for regular arc circuits, the addition of a shunt coil only being required for that purpose.

A Novel Annunciator.

In order to avoid some of the difficulties met with in annunciators, Messrs. Blodgett Bros. & Co., of Boston, have recently designed the arrangement shown in two views, Figs. 1 and 2. In order to prevent the distortion and change of position among the different magnets, each row is mounted on one continuous back-plate of cast metal, to which flanges are secured that support the electro-magnets. Similarly a set of flanges support the targets or drops and the slides for resetting them.

The construction and mode of operation will be clear from Fig, 2. It will be seen that the targets are held raised by lugs attached to their inner sides, which rest on the top ends of the armatures. When the armature is attracted, the target is released and falls, exposing the white signal.

The resetting is accomplished by pressure upon the small knob on the outside of the casing.

This pressure is transmitted within so as to rotate a rod provided with levers and connecting rods leading to the

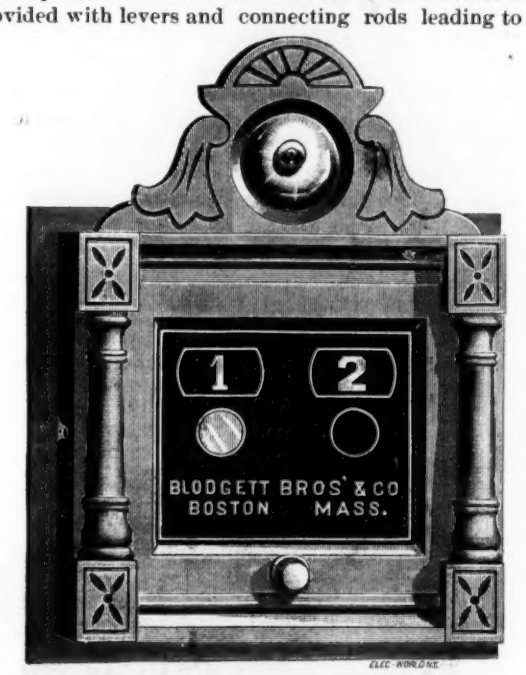


FIG. 1.—A NOVEL ANNUNCIATOR.

magnets. These connecting rods have short lugs which, when the rods are moved, press upon an extension of the target arms and raise the targets to their original position.

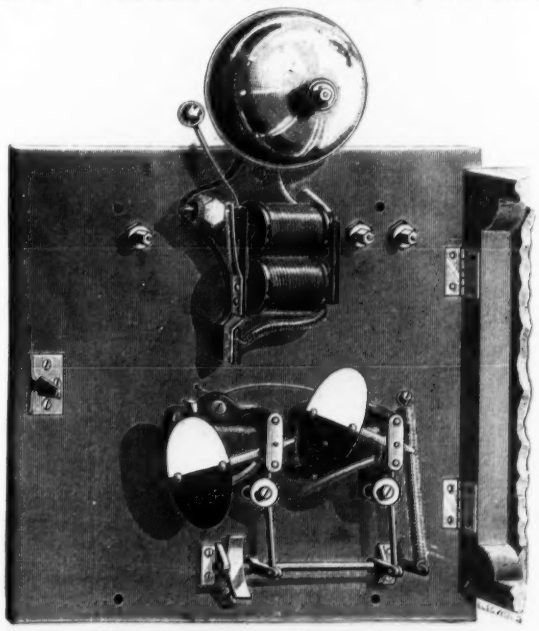


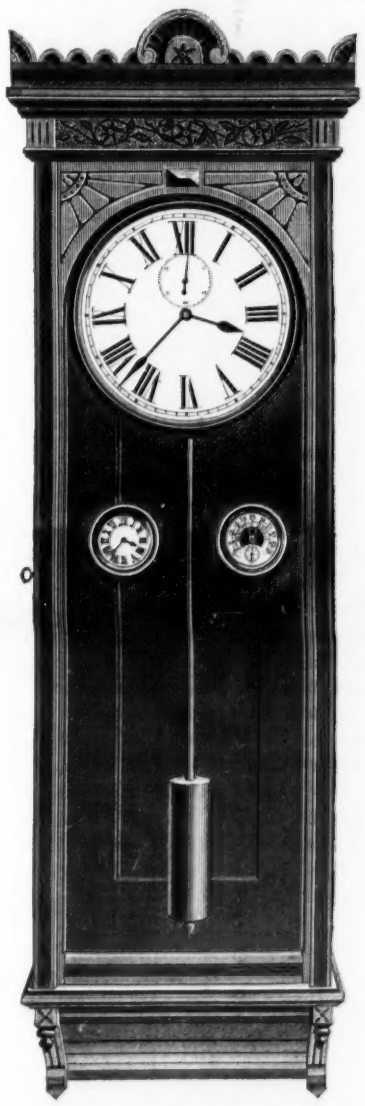
FIG. 2.—A NOVEL ANNUNCIATOR.

Methods of Starting an Arc Without Contact.

It will perhaps be remembered, says the London *Electrician*, that at a recent meeting of the Society of Telegraph Engineers, Prof. Ayrton observed that he should like to make an experiment to see whether an arc could be started between two carbons not in contact by simply bringing a flame between them. Afterwards Prof. Silvanus Thompson said that he had tried this experiment both with a coal gas and with oxyhydrogen, without results; but he had found that a very miuute spark sent between the carbons by a small induction coil, or by any static apparatus, was immediately followed by the full arc. Prof. Ayrton then suggested that the first experiments would probably have a better chance of success in rarefied air. These remarks have an additional interest in view of the fact that the *Comptes Rendus* for April 4 contains a note by M. G. Maneuvrier on the same subject, apparently written in ignorance of Prof. Thompson's experiments (which, it should be added, were carried out as long ago as 1878). M. Maneuvrier, however, not only describes the method of starting an arc by means of a small spark, but he has succeeded where Prof. Thompson failed, and finds it possible by means of a lighted candle to start an arc in the open air. The reason why the experiment did not succeed in the hands of Prof. Thompson is probably disclosed in M. Maneuvrier's remark that the arc commenced to play across "after a time more or less long." Success seems thus to have attended upon the experimenter who exercised the largest amount of patience. It does not appear that the temperature of the flame has much to do with the result, for the experiment succeeds better with a reducing than with an oxydizing flame. This result suggests the explanation that the arc is carried across by the stream of carbon particles passing through the flame; although in that the element of time would appear to be chiefly, if not altogether, accidental. The maximum distance over which the experiment was successful amounted, however, to only 7 mm. even when the difference of potential produced by a Gramme alternating machine between the two carbons amounted before the formation of the arc to 500 volts. M. Maneuvrier has, moreover, discovered a third method of starting the arc without contact. The carbons are inclosed in a glass vessel, and connected as before with a source of alternating E. M. F. The air is then exhausted until a feeble "vacuum" discharge becomes visible; at this moment a stopcock is turned so as to admit a little air, and the arc immediately springs into existence. The first exhaustion need not exceed 5 mm, or 6 mm. of mercury, and the arc is produced when the pressure is again raised to somewhere between 30 mm. and 150 mm. The experiment may therefore easily be repeated with any common air pump. The distance between the carbons may be increased without difficulty to 25 mm. or 30 mm., and is, in fact, only limited by the E. M. F. at disposal.

The Warner Electric Time System.

In large manufacturing establishments, schools and public buildings where the combined work during any one minute of the force may reach hours and days, a method of keeping correct and uniform time in the various clocks is of prime importance. Mr. Ch. D. Warner, part of whose system we have already illustrated in the past, has recently designed the self-winding clock shown in the accompanying illustration. It consists of a regulator with a small indicator electric clock and an electric gauge with the case. The indicator clock denotes the time indicated by the clocks on the circuit, which is a single wire, and the gauge shows the condition of the battery.



REGULATOR, WARNER TIME SYSTEM.

In the bottom of the regulator is a small switch-board provided with means for setting the clocks from it or cutting off either half of the circuit in case of accident, thereby allowing one-half the circuit to be operated independent of the other. The Standard Electric Time Company, of Waterbury, Conn., are now introducing this system of maintaining uniform time on a number of clocks.

American Institute of Electrical Engineers.

With the meetings of May 17 and 18, the American Institute of Electrical Engineers enters upon its fourth year of existence. The annual business meeting will be held on the evening of May 18, and on May 19 two sessions will be held, at which papers will be presented on "Storage Batteries," by Mr. E. P. Roberts; "Results with Hard Drawn Copper Wire," by W. Maver, Jr.; "Novel Phenomena in Secondary Generator Systems," by Prof. Elihu Thomson; "Installation of Electric Lighting Plants," by Mr. J. A. Powers; "Electric Lighting in Trains," by Mr. J. Wetzler and Mr. T. C. Martin; "Note on the differing temperature coefficients of the different coils of a fine rheostat," and "Note on the change from negative to positive of the temperature coefficients of some carbon filaments," both by Prof. W. A. Anthony; and "The best ratio of the section of the core of the Gramme armature to the section of the field magnets," by Mr. D. C. Jackson, of Cornell University.

The "Transode."

BY SIDNEY F. SHELBOURNE.

Noticing the editorial in your issue of April 23d as to the appropriate term to designate the space between the pole pieces and the armature of dynamos, allow me to suggest the word *transode*. Whether we consider the projection of the lines of force from the pole pieces so as to effect currents in the coils of the armature or the motion of the armature cutting across those lines of force, the "space between" is the *odos*, or way, across which, and through which, the thing is done. If we consider the pole pieces and the armature in their physical relations, this space is still the way across or the measurement of the distance from the one to the other. Thus also it is the "windage" across which the air is driven, the "gap," the "interstice" across which we measure the ease or separation of the parts. It will also be the "swim" for the dust floating in the air, which will go ricochetting across this space between the armature and the pole piebes as it swims to the "open" at the horns of the pole pieces, where it will realize a defect of "annulus" in the big breach to the ocean of air outside.

There is another view of this term, transode. If we derive its final syllable from the Greek word *oodey*, signifying a song, a poem, it will also represent the hum of the machine, which by means of the waves generated in and transmitted across the interstitial air will communicate the sublime music of motion—the kinetic harmony of sound—flowing with rhythmic measure of spherical poetry to transform the irritable moods of the operator into that ecstatic grandeur of feeling so appropriate to the true dynamo scientist.

The Retarding Effects of Electro-Magnets in Telephone Circuits.

BY J. O. STOCKWELL.

In following this subject as it has been discussed by Mr. Lockwood and Mr. Farnham, I tried several experiments. I thought, as Mr. Lockwood did, that when the two coils were connected in multiple arc that the induced currents returned on each other; but my experiments, which were quite thorough, convinced me that they did not, or at any rate, only in so far as the coils differed from each other; that is, if one had less resistance than the other it would send out a different current from the other one; therefore, they would return on each other in so far as they did not agree in their E. M. F., and no farther.

Being satisfied by experience that there was a result obtained from connecting in multiple arc that could not be accounted for by the mere shortening of the wire and reduction of resistance, I undertook to account for it by other causes, with the following result;

It is well known that the telephonic current will pass through a coil of wire with a great resistance without weakening it very much, at least not so much as if this resistance were strung out in a long line. There are two reasons for this. The first is that the wire, being shorter has not so much self-induction as the long wire; and second, the fine wire, being wound closely, makes a very fair condenser, and some of the current passes through the coil in that way.

The difference between an electro-magnet wound to 20 ohms and one of 80 ohms connected up in multiple arc would be that the wire in the former is twice as large and as long as one side of the latter. Therefore the self-induced current would be greater in the larger than in the smaller wire.

According to Professor Hughes, the larger the wire, up to a certain size, the stronger the self-induction. Thus it will be readily seen that the sum of the self-induced currents of the two wires of the 80-ohm magnet would not be as great as the one from the large wire in the 20-ohm magnet.

The induced currents from the cores of the magnets will be the same if the telephonic current produces the same amount of magnetism in the 80 ohm as it does in the 20 ohm; but as there is so much more surface in the two smaller wires than in the larger one, and as the two coils in the 80 ohm magnet act like two condensers connected in multiple, while the two in the 20 ohm are connected in series, a greater amount of the current passes through the 80 ohm magnet that does not produce any magnetism in the cores or cause any self-induction in the wires than in the 20 ohm magnet.

From the above I conclude that the advantages of connecting in multiple arc are: first, less self-induction from wire; second, less magnetism produced in the core by telephonic current, and consequently less induced current from that source, and third, more condenser surface is offered.

A New Multipolar Dynamo.

In order to construct a machine which should have a large output with a comparatively small weight of material, Messrs. Ganz & Co., of Budapest, have designed the machine shown in the accompanying illustrations, for which we are indebted to the *Centralblatt fuer Elektrotechnik*.

As will be seen, the machine consists of six fixed electro-magnets which are cast in one piece with the journal bearing, while the ring, supported on one side only, rotates over and around the field magnets.

The armature, which is destined for a 6-pole machine, is wound so that one-sixth of the number of coils will generate the necessary difference of potential of 1,500 volts. These six sections are then joined in parallel in order to obtain a current of 35 ampères. Each of these six sections consists of 56 coils having 12 convolutions each, so that the commutator has $56 \times 6 = 336$ sectors or bars. The sixth corresponding commutator bars are all jointly connected, so that the current is taken off by a single pair of brushes instead of six.

The most recent form of this machine when running at 1,000 revolutions per minute generates a current of 35 ampères at 1,500 volts; and the following data of its construction are of interest:

Resistance of armature	0.97 ohm.
" " magnets	0.28 "
Weight of copper on armature	23.5 kg.
" " " " "	58.5 "

According to the above data, the total output of the machine is 52,500 watts; this gives 640 watts per kilogramme

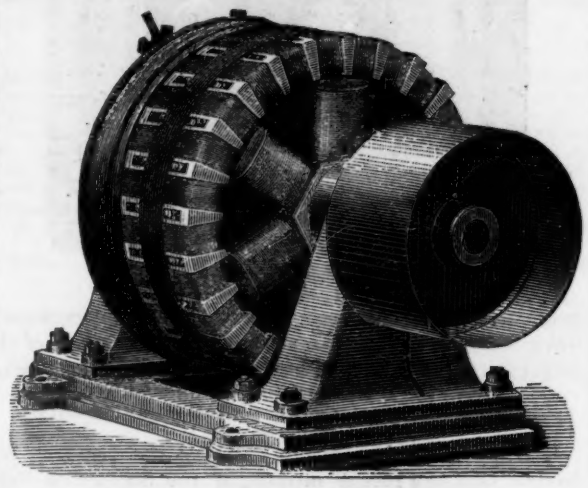


FIG. 1.—NEW MULTIPOLAR DYNAMO.

(about 290 watts per pound) of copper, the total weight of the machine being 685 kg. The electrical efficiency of the machine is 97.2 per cent., according to the above data, which is an unusually high figure, and its commercial efficiency is also high.

The machine was specially designed for the transmission of power where small weight and large capacity are desired. We are informed that Siemens & Halske, of Berlin, have recently undertaken the manufacture of a machine similar to that described above.

Coast Survey Telegraphic Longitude Parties.

The coast survey telegraphic longitude parties of Assistants Smith and St. Clair have left for Ogden and San Francisco. Their first work in extending the regular line of standard longitudes of the coast survey will be to connect Salt Lake City with the Franklin Square observatory in San Francisco. When these points are thus connected, the chain will be complete with the Sierra Robblero, New Mexico, near Fort Selden. Assistant William Eimbeck

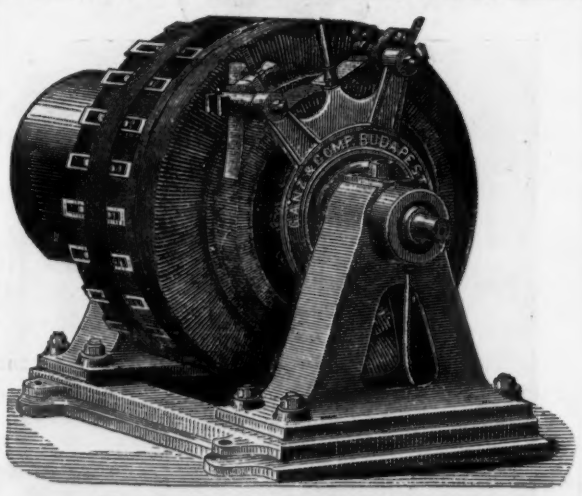


FIG. 2.—NEW MULTIPOLAR DYNAMO.

will continue the transcontinental triangulation from Mount Nebo, near Salt Lake, and is expected to reach that station about May 20. Assistant James B. Baylor has completed his season's work of three months, having occupied twenty-three magnetic stations between Key West and Washington. For absolute measures of declination, dip and intensity, this is considered good work for stations covering so large an area. In connection with the physical and hydrographical survey of New York Bay and harbor, a much-needed work is now progressing, which consists in running a line of precise spirit-levels from the permanent tide-gauge of the coast survey, at Sandy Hook, by way of Keyport, Staten Island, Newark Bay, across New York harbor and the Narrows, up Long Island, through Brooklyn to Long Island Sound, across East River to Governor's Island and up the Hudson River to Dobbs Ferry. A detailed topographical survey of the west half of the District of Columbia is now nearing completion, the results of which are to be published in atlas form on a scale of four hundred feet to the inch. The "Paterson" will leave San Francisco about May 1 for survey work in Alaska waters, where she will remain all summer.—*Science.*

Incandescent Lamps with Intermittent Currents.

To the Editor of The Electrical World:

SIR: If an incandescent lamp is supplied with currents of uniform potential and like polarity and of $\frac{1}{111}$ of a second's duration, and the lamp is cut out of the circuit for $\frac{1}{111}$ of a second between every such pulsation, will this making and breaking of the current tend to destroy the filament of the lamp more quickly than an absolutely continuous current? and will the lamp be any less effective in candle-power than when supplied with an absolutely continuous current of equal E. M. F.? H. F. A.

PITTSBURGH, Pa.

ANSWER.—It is better to run an incandescent lamp with a steady current than with a pulsating one, as it has often been recorded that lamps run on storage battery circuits will last longer than when run with dynamo currents, because the latter are always of a more or less pulsating character, except in the case of unipolar machines, which are like batteries in this respect. The difference may, however, be very slight, unless the pulsations are very great, as in your case. On the other hand, it is claimed that with the alternating systems now in use, the life of the lamp is prolonged. Another reason why it might be thought to injure the filament may be noticed in some lamps, particularly those with fine filaments. It is that, as the current is turned on slowly the filament is seen to change its shape. As this bending of the filament accompanies the starting and stopping of the current it may have a tendency to injure the lamp, though how much we are unable to say. Unless your source of power is like a battery, in which it is impossible with an intermittent current to have a higher potential than that of the battery, the potential of your lamp will probably not be uniform as you state, but will be apt to be higher during each pulsation than the mean potential which shows itself at the lamps or in a measuring instrument. This higher potential, caused by the extra current, if it exists to any great extent, will tend to decrease the life of your lamps. From your figures it appears that during three-fourths of the whole time the lamp is out of circuit, as the time in which it is in circuit is one-third of the time in which it is not in circuit. If, as described, you use a battery, in which the potential can never increase to any great extent, you must expect to obtain less than one-fourth as much light as you would have if you kept the lamp in circuit continually, because you are using only one-fourth as much energy in your lamp. As the lamp cools off during three-fourths of the time, it will evidently not be as bright as if the same current passed continuously. As your potential acts during only one-fourth of the time, the mean potential will be much less; with a 100-volt battery, for instance, the mean potential at the lamp would be the mean between 100 and 3 zeros, which is 25 volts. If, therefore, you use a 100-volt lamp in this case, it will be much less efficient, as the efficiency in candles per volt diminishes with the brightness of the filament. If, on the other hand, you use a 25-volt lamp it may be just as efficient as if run in the ordinary way, but it will be subjected, at every pulsation, to 100 volts, which will undoubtedly diminish its life. It will be likely to produce what is called the "Crookes effect," which tends to destroy the filament at the terminals.—EDS. E. W.

Power Required for Operating Motors.

To the Editor of The Electrical World:

SIR: Will you please answer the following questions in your columns: 1. If it takes 1 h. p. to run a one arc-light dynamo, will the same current run a 1 h. p. motor (the lamp not being in use)? 2. If a 10-light dynamo be put on to ten 1 h. p. motors is the resistance of each motor equal to the resistance of an arc lamp?

COLUMBUS, O. W. B. BURKE.

ANSWER.—1. If both the dynamos and the motor were perfect machines, a one h. p. dynamo would run a one h. p. motor. But as there is a loss in both, besides a loss in the line, it would require a larger dynamo to run a one h. p. motor. If the efficiencies of the dynamo and the motor were each 80 per cent., and the loss in the line 10 per cent., a one h. p. dynamo would give

$$\left(\frac{1 \times 80}{100} - \frac{10}{100}\right) \times \frac{80}{100} = .56$$

or a little more than half a horse-power available at the motor. On the other hand, to develop one useful horse-power at the motor would require, with the same efficiencies and line, $1 \div .80 = 1.25$ electrical h. p. at the motor; $1.25 \div .90 = 1.39$ electrical h. p. at the dynamo end of the line, and $1.39 \div .80 = 1.74$, or about 1¾ h. p. to drive the dynamo. 2. If the resistance is calculated from Ohm's law, that is, by dividing the potential by the current, then the virtual resistance of each motor will be equal to that of an arc lamp. But this is only the *apparent* resistance; it includes the counter electromotive force expressed in ohms. It will, therefore, vary with the speed and the amount of work the motor is doing, and will be much greater than the real resistance of the motor measured when at rest. The greater the apparent resistance, as compared with this real resistance, the more efficient the motor will be.—EDS. E. W.

A Dynamo Regulator.

Among the recent improvements made in the well-known Mather type of dynamo is that effected by Mr. Ch. G. Perkins and relating to the regulation of the machine. One of the methods employed consists in varying the position of the brushes on the commutator to correspond with the load, and this is effected by the apparatus shown in perspective in Fig. 1.

Fig. 2 shows an enlarged detail which makes clear the method of operation. It will be seen that a yoke *J* encircling the armature shaft supports two friction wheels *M* and *N*, which are constantly in contact with another wheel *L*, supported on top of the bearing, and having a gear wheel at the other end of its shaft, which meshes with a rack-segment on the yoke carrying the brushes. Two magnets *K* and *K'* are arranged with their poles opposite each other in a position to act on the armature *j*, carried by the

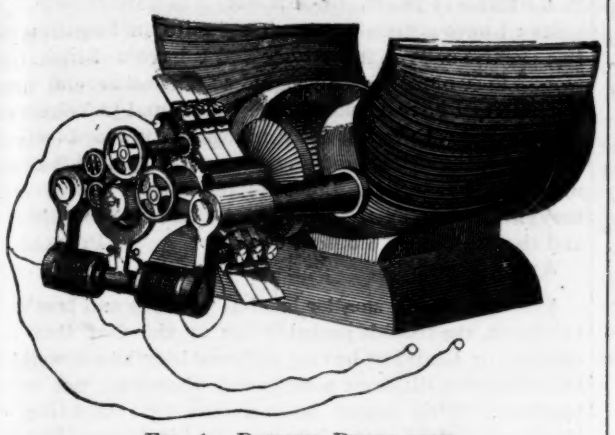


FIG. 1.—DYNAMO REGULATOR.

frame *J*. The magnet *K* is of low resistance, and is included in the working circuit of the dynamo, while the magnet *K'* is of high resistance, and is included in a shunt to the main circuit.

When the circuit is in proper working condition, the frame *J* hangs vertically and the tendency of the magnets *K K'* will be to keep the armature *j* midway between the two poles. If, now, for any reason the resistance of the working circuit becomes diminished, or the current of the dynamo is increased by reason of a more rapid rotation of the armature-shaft, or from any other cause, the magnet *K* will be energized more strongly and its power will overbalance that of magnet *K'*, thereby drawing the frame *J* and its connected parts to the right. This will have the effect of bringing the periphery of wheel *O* into contact with that portion of the shaft *A* which is covered with frictional material. Consequently as the shaft rotates in the direction of the arrow it will move the wheel *O* to the left, causing wheel *N* to rotate to the right and wheel *L* to the left. This will rotate the gear wheel connected to *L*, and will cause the brushes to move in a direction opposite to that of the dynamo shaft.

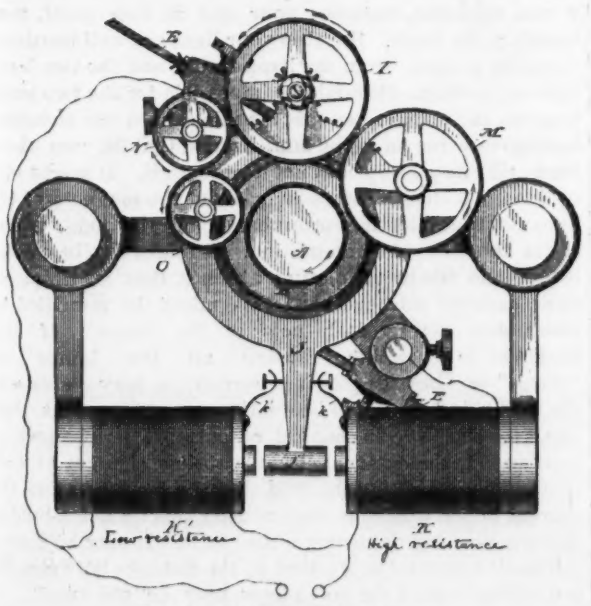


FIG. 2.—DYNAMO REGULATOR.

The motion of the brushes gradually diminishes the current until, finally, the relations of magnets *K* and *K'* are such that equilibrium is established between them. The frame *J* then resumes its normal central position, and the brushes remain in their new position until another change in the current requires their regulating action. If, on the other hand, the resistance of the outer circuit increases, the reverse action takes place. The armature *j* is drawn in the opposite direction, which brings the wheel *M* in contact with shaft, *N*, and causes the brushes to be shifted in the opposite direction.

It is evident that the same principle and mechanism can be employed to operate a regulating resistance placed in the shunt circuit of the machine, and such an arrangement has also been devised by Mr. Perkins.

Herz Push-Button Telephone.—The French Minister of Posts and Telegraphs, on the report of a commission, has ordered the introduction of the Herz telephone in all the administrative departments.

A Combination Electric Clock.

Where signals are required to be given at definite times, and the movements of individuals, such as those of watchmen, must be "checked," an apparatus combining in itself the various functions is evidently of considerable value. The Electric Gas-Lighting Company, of Boston, have recently brought out a combination electric clock which embraces in itself no less than four functions, namely, those of an ordinary time clock, a synchronous time clock, for regulating other clocks in circuit with it; a signal clock, and a watchman's detector.

The accompanying illustration shows the entire apparatus inclosed within a single case. An accurate time-piece occupies the upper section and affords also a perfect system of regulation of clocks located at other points in the building and electrically connected with it over a direct circuit. Thus when the hour of noonday is indicated on the dial of the office clock, the same hour will be precisely registered on the dials of all the other clocks placed in the circuit. This arrangement is valuable in factories, warehouses and in railroad offices and stations.

The signal clock arrangement is placed directly below the time-piece. By means of a paper belt, properly graduated and adjusted to the main pinion of the time mechanism, and also perforated so as to afford, at desired inter-

A COMBINATION CLOCK.

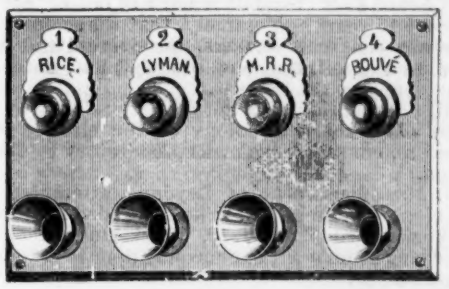
vals, a perfect closing of the electric circuit, a gong can be made to ring at any distant point. If the clock is located in a railroad office, a gong located somewhere in the station can be sounded automatically from the office to indicate the starting of the various trains; it being necessary to so arrange the perforations and to adjust the belt that the ringing of the gong shall correspond with the local time and the time-table. In the same way the hour for stopping work in a factory may be sounded directly and automatically from the office.

The watchman's detector, which occupies the lower space of the case, is so constructed that the watchman is obliged to visit each part of the building where a station is located, and in regular order, or the clock will not register. No station can be skipped by the watchman in going his rounds, for the reason that the remaining stations will not register until all previous stations have been visited in their proper order. The apparatus has also an automatic attachment by means of which an alarm, stationed, for example, at the house of the superintendent, is rung when the watchman fails to register at the proper place. An additional attachment causes the same to ring in case of the clock stopping or breaking down. The entire apparatus is tamper-proof, and the slightest irregularity on the part of either watchman or clock is instantly signified by the alarm. The combination, altogether, requires only three cells of battery for its operation.

Combined Speaking Tube and Call Bell System.

With the advent of electric bells, many new systems of calls and signals in connection with speaking tubes, for public and private buildings, were made possible. This was especially so in the case of large buildings devoted to offices. Indeed, the constant increase of such buildings in our large cities has also developed a system of tubes with electric calls, connecting the vestibules of such buildings with each office. In the vestibule, the entire system is centered in a fine marble slab, as shown in illustration. The slab contains a mouth-piece plate with the number of each office and names of occupants, all arranged in regular order, together with a push button for giving the required signal. All offices are thus placed in direct speaking communication with the main entrance of the building, and thus is obviated the loss of time in ascending elevators or stairs to obtain information that is instantly conveyed to the inquirer through this system of tubes and calls.

In many cases a return call annunciator is placed above



SPEAKING TUBE AND ELECTRICAL CALLING SYSTEM.

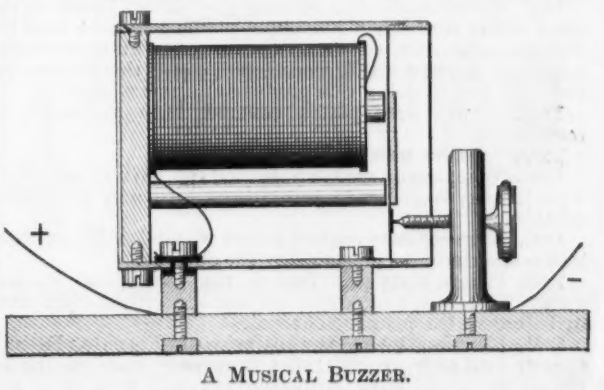
the cluster of tubes, thus allowing all tenants to communicate their many wants to the janitor of the building, without either party leaving his station.

The advantages of this system of electric calls and bells has been fully appreciated by both owners and architects, notably so in the city of Boston, where all new office buildings are fully equipped with this novel system, which has been designed by Messrs. Fuller, Holtzer & Co., of that city. Among the large buildings recently fitted up with the system may be mentioned that of the Boston *Daily Globe*, the Massachusetts Hospital Life Insurance, the Mutual Life, Dexter, and other fine edifices.

A Musical Buzzer.

In a recent number of *L'Electricien*, a novel form of buzzer, designed by M. Zigang, is described. The apparatus, which is shown in section in the accompanying illustration, consists of a brass tube 6 cm. in length and 4 cm. in diameter, within which is fixed a horseshoe electro-magnet with only one leg wound. The armature consists of a disc held at its periphery by a socket screwed into the tube and carrying a bar of iron at its centre opposite the poles. The make and break is made as usual, a platinum-pointed screw serving as an adjustment.

Two cells of Leclanché are sufficient to cause the vibrating disc to emit an agreeable musical tone, the pitch of which can be regulated by the adjustment of the screw. For domestic purposes or office use, where a shrill call-



A MUSICAL BUZZER.

bell is not desirable, the apparatus is well adapted, and it is even suggested that it could take the place of the telegraph sounder.

Telegraphy In Montreal.—A special dispatch of April 29 from Montreal says: Another difficulty has arisen between the Montreal and the Great Northwestern telegraph companies. The directors of the Montreal Company sent Mr. Ross, their secretary, to Toronto to examine the books of the Great Northwestern, but the latter company refused to allow him to see the books until they had received advice from New York. Mr. Ross returned yesterday and served a protest upon the Great Northwestern, and if the directors of that company do not immediately comply with the provisions of their charter criminal proceedings are to be instituted against them. The capital of the Great Northwestern is $500,000. Of this only $50,000 has been paid up, whereas according to their charter 10 per cent. must be paid up every year and the whole capital at the expiration of 10 years. The company has now been in existence for seven years, so that the directors are now liable for $300,000, their failure to pay it being a misdemeanor under the act. The directors are all moneyed men, including Erastus Wiman, president; H. Gooderham, vice-president, and O. S. Wood and H. B. Dwight. The Montreal Company having discovered that the Western Union, the guarantor of the dividends of the Great Northwestern, has over $1,500,000 of property in Canada, they will, if necessary, take proceedings in Canada.

A Short History of the Storage Battery.*

BY DR. P. H. VANDER WEYDE.

In the March number of the *Manufacturer and Builder* for 1873, I published a chronological account of the invention of the electric telegraph as a forcible illustration of the power of accumulated human intellect, showing how, by assiduous investigation, scores of the most ingenious men discovered facts upon facts, and how, standing mentally on the shoulders of predecessors, the inventors of the present period have wrought out the most surprising results.

I remarked then, and I repeat it now, with emphasis, that one of the first duties of the true scientist is to "give honor to whom honor is due." The fact is that recent brilliant inventions tend to eclipse former more valuable discoveries on which they are based, and as the names of great investigators and laborers in the course of scientific progress are often ignored, a chronological record is a deserved tribute to their otherwise forgotten merits. But it is more than this, it is highly instructive and eminently adapted to give us a clear insight into the subject we are considering. It is especially to be recommended to young searchers after knowledge, who, having perused a few of the modern publications on a subject, are very much inclined to think, prematurely, that they know all about it.

Such a chronological account illustrates the truth of what I heard Prof. Tyndall remark in one of his lectures here some 15 years ago, namely, that the scientific investigators are the real workers, discoverers and inventors. They plow the soil, they sow the seed; but, unfortunately, they seldom reap the harvest.

I will not mention data not directly related to electrical storage. My other chronology on the electric telegraph, referred to, contains what was preparatory to this field of research.

1745. Musschenbroek, of Leyden, attempted to store static electricity in a bottle; he succeeded in storing it for a very short time only, 10, 20 or more seconds; such storage was of no practical account, but it caused him to discover the principle upon which his invention of the Leyden jar is based.

1783. Volta invents the condenser, based on the same principle, of which the enlarged and improved form is now so indispensable in the duplex and quadruplex systems of telegraphy.

1800. Volta invents the voltaic pile, a battery consisting of two different metals and a liquid.

1801. Gautherot discovers that the electrodes through which a voltaic battery has been discharged become capable of producing a current.

1801. Erman discovers that the electrode connected with the positive pole, when disconnected from the battery, will return a positive current; in fact he discovers what we now call the principle of polarization.

1801. Ritter, observing the same facts, succeeds in decomposing water by means of the polarized electrodes and then demonstrates the inversion of the currents.

1802. Ritter makes the first secondary battery consisting of a pile composed of discs of a single metal, copper, separated by a liquid, which becomes charged by passing the current of a voltaic battery through it, and produces all the phenomena of the primary, decomposing water, heating and burning wire, giving sparks, shocks, etc.

1803. Ritter constructs secondary batteries with plates of large size, and compares the results with those of smaller size.

1803. Ritter finds that copper is not the best metal for secondary batteries, and experiments with tin, zinc, lead, iron, bismuth, brass, silver, gold and platinum. He finds the best results with carburet of iron and oxide of manganese.

1805. Izarn describes in his *Manuel du Galvanism* five or six modifications of secondary batteries.

1826. Nobili deposited peroxide of lead on lead plate by means of a primary battery.

1837. Schönbein demonstrated that plates thus prepared possessed the property of giving a current like a primary battery.

1842. Grove made his famous gas battery based on the observation that when platinum plates had been used for the decomposition of water by the current they would, when the battery was disconnected, cause the gases to recombine and in doing this produce an inverse current.

1843. Grove used plates covered with peroxides of metals.

1843. Siemens uses carbon plates.

1843. Wheatstone makes a secondary battery of platinum plates covered with peroxide of lead and potassium amalgam.

1853. Siemens uses carbon plates covered with oxide of lead converted into peroxide by the current.

1859. Planté finds that lead is the best metal for secondary batteries, and covers the surface with the peroxide by means of the primary current.

1861. Kirchhof makes the batteries of alternate plates of spongy lead and peroxide; also proposes to store up atmospheric electricity from insulated lightning rods, or to use magneto-electric machines for this purpose.

1866. Percival uses metal plates covered with crushed coke and powdered lead in diluted sulphuric acid.

1869. He uses a positive electrode of amalgamated zinc and a negative of lead.

1879. D'Arsonval uses carbon plates covered by oxide of lead and manganese and zinc plates in a solution of zinc sulphate.

1881. Faure creates surprise by a battery claimed to give superior results, and occupying less than a cubic foot of space, charged by a very slow process of forming.

1882. Faure obtains a United States patent for a device which is similar to Planté's, but of which the claim is in a very general and vague form.

PROF. VANDER WEYDE exhibited various forms of storage battery by means of the lantern, and among them that of Van Gestel, recently described in THE ELECTRICAL WORLD. He also showed slides of a large number of early motors, and exhibited several models from his own collection.

*A paper read before the Electrical Section of the American Institute, April 27, 1887

The Telegraph in India.

We have received a copy of the *Indian Telegraph Guide*, for April, 1887. It is a remarkable evidence of the extent of the growth of the telegraph in the far east. It is a bulky little book 8½x5½ inches, and contains no fewer than 138 pages of rules, instructions, forms, list of offices, rates, etc. The *Guide* is at once interesting and suggestive, and is full of details such as can only belong to a service under the conditions prevailing in India. Thus, for instance, a list is given of public officers who on occasions of great importance have the power to "clear the line," or, in other words, suspend the receipt and dispatch of all other messages until their own telegraphic business is transacted. A list of offices opened and closed at certain times mentions some which are closed "during the rainy season." Another list of offices open at special times "to suit local requirements" includes a great many open, say, from 7 A. M. to 8 A. M. and then from noon till 5 P. M. or from 2 to 6 P. M. The system is evidently well worked out, and its efficiency no doubt contributes largely to the security of the Indian Government as well as the comfort of the Queen's Indian subjects. In a private letter to one of the editors of THE ELECTRICAL WORLD, Mr. P. V. Luke, Superintendent of Telegraphs, writing from Calcutta, gives an account of the extent of the work done. We quote the following passage: "On the 31st of March, 1886, we had 27,500 miles of telegraph line, with 81,500 miles of wire belonging to the department, and 187 miles of river cable. This is exclusive of lines belonging to the railway companies. The message traffic is increasing so rapidly that the need for the quadruplex is beginning to be felt, and we have just started a quaduplex circuit between Madras and Bombay, 800 miles, with one translating station. In all probability we shall extend the system gradually over most of our main lines. We have been very busy in Burmah, with over 1,000 miles of field telegraphs and new lines connected with the recent annexation of that territory, and the work is constantly extending in a very trying country."

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Telegraphers in India have to do their work under many special and peculiar circumstances of difficulty, some of which the above extract gives an idea of.

The Thomson-Rice Distributor.

Where incandescent lamps are run in multiple series with arcs, a distributor is required to guard against the passage of abnormal current in lamps of the same group when the filament of one or more is ruptured or a lamp turned out. Such a distributor, designed by Messrs. Thomson and Rice, of the Thomson-Houston Electric Company, is shown in the accompanying illustration.

It consists of a neat brass case containing a magnet in the circuit of the lamp and a resistance coil which is automatically substituted in case the incandescent lamp should break, or in case it is desired to turn off the lamp by means of a key socket. Each individual distributor takes care of but one lamp, and it is therefore necessary to use as many distributors as there are incandescent lamps in the group. The number of lamps to be used in a group depends on the current required by each lamp, and also the amount of current passing over the line upon which the lamps are placed. As usually made, the lamp for this purpose is one which takes about 1¼ to 1.3 ampéres, and gives from 20 to 25 c. p.

The distributor is rigidly attached to a pipe-fixture attached to the ceiling, and the lamp is suspended from it by flexible cord, as shown in the illustration. Other details of the system were given in our issue of Jan. 29, 1887. In that article was described the incandescent lamp made to run in series with the arc lamps and taking the full arc current.

Names for the Unnamed Space.

To the Editor of The Electrical World:

SIR: A new word might be coined from other words or parts of them to suggest the "interironical" space in the dynamo. Thus, we can take zone, or "zo"; cycle, or "cyc," cestus, or "cest"; ring, hoop, way, pass, room, break, cleft, or "clef"; foss, chink, rift, or "rif," "int" or "inter." We can have "intfer" or "entfer" "kintfield" from kinetic field "sparm" from space and armature; "disp" from diamagnetic space; or "armp" from armature and pole. In some such way as this an addition could be made that meets a want, to the already large new vocabulary of electricity. K. G.

NEW YORK CITY.

A Frequent Trouble with Bells.

To the Editor of The Electrical World:

SIR: I have a metallic circuit one mile in length with two electric bells on it. At one end I have a 7-inch bell wound to 20 ohms resistance, and at the other end near the battery I have a small 3-inch bell wound to 5 ohms resistance. But they will not ring together unless I substitute the electro magnets in the smaller bell with a pair wound to the same resistance as the larger. Why will they not work together, the large bell being a vibrator and the small one a single stroke? PUZZLED.

WILKESBARRE, Pa.

ANSWER.—If the smaller bell has no make and break attachment, the trouble probably lies in the fact that the clappers or hammers having different lengths and weights will vibrate in different periods and, therefore, not work together. This might be overcome by weighting or lengthening the lighter clapper so that it is more like the other; or else by using a larger number of cells so as to force it to strike in unison with the other. Possibly it might answer to increase or diminish the distance of vibration of the make and break clappers. Another method is the one you suggest, that is, to make the magnets of the smaller one more powerful by increasing the number of turns of wire and consequently its resistance, so as to get greater magnetic effect.—EDS. E. W.

Flashing at the Commutator.

To the Editor of The Electrical World:

SIR: What is it that makes the brushes flash, and makes the lights flicker? The dynamo runs along apparently all right for some time, and all at once the brushes will commence to flash. Sometimes I can stop it by moving the brushes and sometimes it stops of itself.

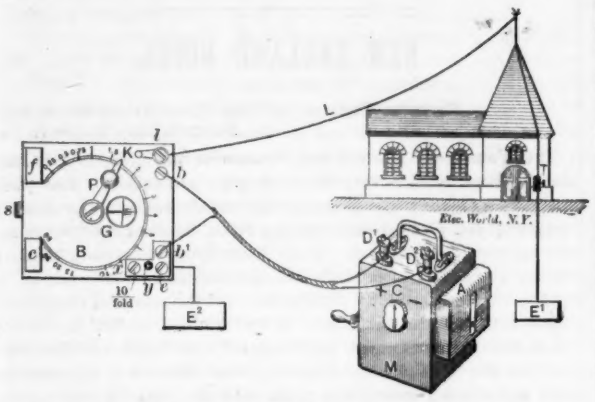
MASON CITY, Iowa. FRANK KELLOGG.

ANSWER.—There may be several reasons for this. It might be a "live contact" on the line or the lamp. This would decrease the resistance, thereby developing a strong current suddenly, and this is apt to make the machine flash. If due to this, it will probably show itself soon, as it will, no doubt, burn out your line at that point, thus locating the fault. See that your lines are well insulated from the ground, from the lamp frame, and the two leads from each other. It should be impossible for the two leads to touch each other. See that the rain cannot run along the leading-in wires on to the lamp frame; that is, run these leads *up* into a lamp and not *down* into it. It might also be due to a live contact in or about the magnets of the dynamo, thus shifting or unbalancing the field, which shifts the line of commutation. It might also be caused by all the lamps regulating at once, that is, dropping their carbons all together; this might be remedied by using slow acting dash pots in the lamps. If this flashing is periodic causing all the lamps to "surge" or "breathe," as it is termed, it may be due to the field being too much below the saturation point, thus being too sensitive to changes of currents or changes of resistance in the external circuit causing changes of current. Oversaturating the field slightly, by increasing the current or the windings may remedy this; a quick-acting and sensitive regulator might also do it. It may be due to too small a neutral field—that is, the distance between the projecting ends of the pole pieces may be too small. It may be due to too few commutator bars. The portion of the electromotive force generated in an armature coil, whose commutator bars are near the brushes, should not be greater than 20 volts, otherwise the machine will be very apt to flash. If you regulate the potential by moving the brushes this flash is very apt to occur unless you regulate the magnetism of the field magnets at the same time. It may also be caused by the brush resting on too many commutator bars; it should, in good machines, touch only two or, at most, three. The flash may be stopped either by breaking the circuit by removing the brush, or sometimes by moving the brushes in the direction to increase the potential, not to decrease it, as that may make it worse, but this may depend on the style of the machine. It is also possible that in the case of a machine having air spaces between the commutator segments, the oil employed to lubricate the commutator is carbonized and bridges across, thus short-circuiting the windings on the armature. Therefore, see that the air space is kept clean at all times and use only the best mineral oil on the commutator.—EDS. E. W.

Apparatus for Testing Lightning Conductors.

In a pamphlet recently issued by Messrs. Siemens Brothers & Co., of London, Eng., a new form of apparatus for testing lightning conductors is described with the improvements such that even those not skilled in electrical work can use the n to advantage.

A view of the apparatus is shown in Fig. 1. The galvanometer is represented as removed from the compartment provided for it in the bottom of the case containing the magneto-generator and is in connection with the terminals of the latter. Fig. 2 is a general plan, and Fig. 3 a diagram of the connections between the magneto bridge-board, two earth connections, and the lightning rod. The apparatus consists of a magneto *M* inclosed in a wooden case, and bridge-board *B*. On the latter are fixed a ring of German silver wire (forming the *A* and *B* branches of a resistance bridge), a contact-lever *P*, which can be moved over the ring and used as a battery-key; a small horizontal galvanometer *G*, a brass sliding piece *s*, for putting the galvanometer needle in and out of action, four terminals, *b*, *b*¹, *e*, *l*, and *R* (see Fig. 2) the comparison resistance of the bridge. A small key *K* is fixed to terminal *l*, and the resistance *R* is underneath the bridge-board. A leather bag *A* at the side of the wooden case, Fig. 3, serves to hold the double conductor leading wire, which is used for connecting the magneto terminals with the bridge-



FIGS. 1 AND 3.—TESTING LIGHTNING CONDUCTORS.

board. The weight of the complete apparatus is 9 lbs., and the dimensions are about 6″ × 6″ × 9″. By means of this testing instrument the low electrical resistance of lightning conductors, earth connections, and leading wires of electric light installations, as well as the higher resistances of line wires for telegraphic and telephonic circuits, connection wires in telegraph stations, etc., can be measured, the range of the instrument being from 0.1 ohm to 500 ohms. The measurement of a resistance is read off direct without the trouble of making any calculation.

The connections for testing are made as follows: Terminal *l*, Fig. 3, is joined to the apex of the lightning con-

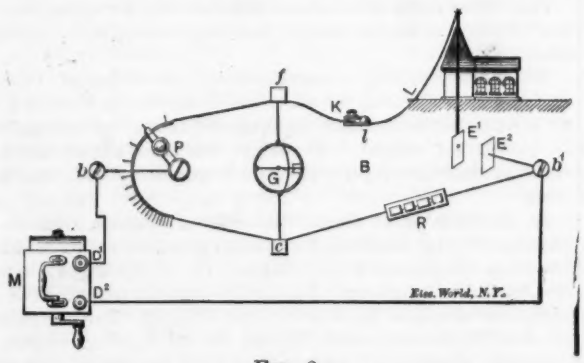


FIG. 2.

ductor by means of a length of leading wire, which may be either bare or insulated. If bare wire be used precautions must be taken that no part of it, throughout its entire length, makes contact with any object so as to short circuit the current. Terminal *e* is put to earth, that is, a connection is made by means of a stout piece of copper wire between this terminal and a gas and water-pipe, and, should not these be at hand, any metallic body in intimate contact with wet earth may be used in place of the pipes. When no such earth connection is available, a special copper-plate (E^2), must be employed, and put underground at such a depth as will insure all parts of the plate being in good contact with moist earth.

Terminals *b* *b*¹ are joined to D^1 D^2 of the magneto, Fig. 3, by means of the double conductor leading wire in the bag *A*. The bridge board *B* must stand as far away from the magneto *M* as the leading wire will permit, so that the galvanometer *G* may remain as much as possible out of range of the magnetic and inductive influence of the permanent magnets and revolving armature of the magneto.

After the slide *s* has been withdrawn and the galvanometer needle set free, the bridge-board must be so placed that the needle plays freely over the scale, and finally points to zero when at rest. The bridge-board is then fixed by means of brass weights or clamps in the position thus found, but no iron must be used for this purpose. All connections must be firmly made and the attachments of the earth-wire to a water-pipe, gas-pipe, etc., should be well soldered.

The tests are taken by two persons, one at the magneto and the other at the bridge-board. The magneto switch *C* is moved so that the arrow points to the positive sign +; the handle of the magneto is then turned so as to keep the speed at a uniform rate. While the latter is being turned, the key *K* of bridge-board is depressed with one hand and the pointer *P* with the other. The current from the magneto then traverses the bridge and a deflection of the galvanometer needle is produced; the key *K* is still held down and the pointer *P* kept depressed and moved a little to the right and left, observing at the same time which of these movements cause a decrease of the deflection. As soon as this is ascertained the pointer is kept moving slowly around the German silver ring until a point is

FIG. 4.

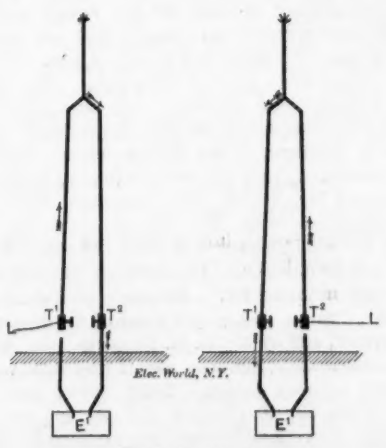
found which brings the galvanometer needle back to zero. The figure over which the pointer *P* now rests is recorded on a piece of paper. It gives in ohms the total electrical resistance of the lightning conductor and its earth connection, leading wire between the apex of conductor, and terminal *l* and earth-plate E^2.

The switch *C* is now moved so that the arrow points to the negative sign, —, and the handle of the machine turned as before. A slight deflection on the galvanometer will be observed, and the pointer *P* must be moved to one side or the other of its first position until the needle again points to zero. The figure now under the pointer must be read off and also noted down. It gives the total resistance in ohms, when the test is taken with a negative current, the previous one having been made with a positive current.

A number of these reversal tests may be taken and the mean of all tests will give the correct resistance of the conductor, leading wire and two earth connections. The resistance of the leading wire *L* and the earth-plate E^2 is so low that it may be neglected; the mean of the tests, therefore, can, in practice, be taken as the actual resistance of the lightning conductor and its earth connections E^1. A resistance of more than 20 ohms shows the conductor to be in such a state as to have become a positive danger to the building to which it is fixed.

While the tests are being taken, the bridge-board *B* must be kept in its normal position, that is, with the galvanometer needle pointing to zero, so long as the key *K* and pointer *P* are not depressed, and the screw marked $\frac{10}{\text{fold}}$, Fig. 3, must be well secured between the terminals *e* and *x*.

At the time a lightning conductor is erected, one end of



FIGS. 5 AND 6.

a length of copper wire should be firmly soldered to the apex of the conductor. This wire is carried down loosely by the side of the conductor and remains permanently in position so as to be available for connection with the testing instrument whenever the entire length of the conductor has to be tested. By this means, the trouble and expense of attaching a fresh leading wire for every test are avoided.

A fault in a conductor is usually due to a bad earth-connection arising from partial or entire fracture of the conductor just above or below the ground line. In some cases, the lower end of the conductor is in dry ground, and in others, the earth-plate is either too small or is oxidized and broken. The earth connection should, therefore, be tested first of all and for this purpose a strong brass clamp with terminal screw *T*, Fig. 3, should be secured to the conductor just above the ground line and well soldered. A separate short length of leading wire is then used for connecting terminal *l* of the bridge-board with terminal-screw *T* on the lightning conductor.

Double rod conductors of the same sectional area as a single one can be erected. The testing of conductors of this kind is very readily carried out. The upper end of each rod, Fig. 4, is well soldered to a point common to both rods, and at the base, the two ends terminate just above the ground line. To the earth-plate *E'* are soldered two rods which terminate close to the upper ones and are joined thereto by means of connection screws T^1 T^2. Either of these screws can be connected to the testing instrument by a leading wire.

To test such a twin conductor first one rod at T^1 is disconnected, Fig. 5, and one end of the leading wire joined thereto, the other end being connected to terminal *l* of bridge-board, as in Fig. 3. The test is then made as described in the case of single conductors and the continuity of the right-hand rod tried. The left-hand rod is tested in the same way, after the connections have been made, as shown in Fig. 6. In erecting a double conductor, the two rods must be kept some distance apart throughout their entire length, and not touch any piece of metal forming part of the building, so as to obviate all risk of the two rods being short-circuited. After the tests have been taken, the connections must, of course, be remade, as in Fig. 4.

The testing of lightning conductors should be carried out in dry weather, as better and more concordant results

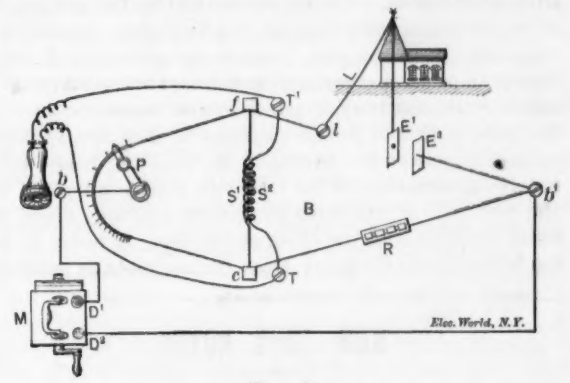


FIG. 7.

are obtained than in a damp state of the atmosphere, when buildings are covered with moisture.

When the earth connection E^1 is connected to terminal *l*, and earth-plate E^2 to terminal *e*, Fig. 3, a weak current, due to the difference of potential of the two earth-plates, passes through the galvanometer and deflects the needle, which, under these conditions, cannot be maintained in its normal position at zero. This difficulty is, however, overcome by the introduction of the key *K*, which prevents any current from traversing the galvanometer until the key be pressed down. When adjusting the bridge-board, the key *K* is open and the needle can readily be brought to zero, as it remains free from the disturbing influence of the current set up between the two earth-plates. As soon as the key *K* is depressed, the circuit

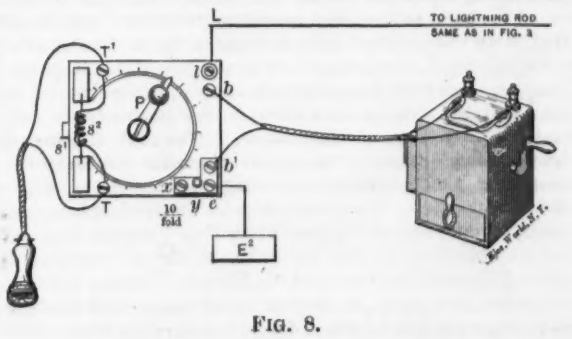


FIG. 8.

formed by the two earth-plates E^1 E^2, lightning conductor, leading wire *L*, key *K*, *f*, galvanometer *G*, *e*, *R* and *b*¹, Fig. 2, is completed and the needle deflected. When accurate tests are required, this deflection, which is clearly due to a current between the earth-plates, must be eliminated by taking a few tests alternately with positive (+) and negative (—) currents. The figures obtained in the one case will be too high, and in the other too low, but by taking the mean of the results, the resistance of the lightning conductor is obtained with sufficient accuracy for all practical purposes.

The continuous current from the magneto has an electromotive force of about 5 volts, which is sufficient to polarize the two earth-plates E^1 E^2, and thereby increase the resistance to be measured. This effect impairs the correctness of the tests in direct proportion to the time occupied in taking each test. The necessary measurements should therefore be made with as great rapidity as possible. By means of the switch *C*, Fig. 3, the tests are taken with reversed currents, in order to neutralize the polarization of the earth-plates.

For testing telegraph and telephone lines, as well as other resistances higher than those of lightning conductors, the brass screw marked $\frac{10}{\text{fold}}$, Fig. 3, which connects *e* and *x*, must be removed. The readings now obtained by means of the pointer *P* must be multiplied by 10 in order to give the true resistance of any line, etc., under measurement. The range of the instrument when the $\frac{10}{\text{fold}}$ screw is in its place is 0.1 to 50 ohms, and without this

screw, 1 to 500 ohms, thus enabling the operator to measure small resistances as well as comparatively high ones without making any alteration in the connections. The tenfold screw when removed from its usual place is put into the hole *y* provided for it.

In order that resistance tests may be taken by means of the telephone in conjunction with the magneto and bridge-board, as proposed by Captain Addison, R. E., Secretary of the Royal Engineer Committee, Messrs. Siemens Brothers & Co. have introduced another form of the apparatus, shown in Figs. 7 and 8.

In this arrangement a telephone is connected to the terminals $T T^1$, the centre of the bridge being occupied by an induction bobbin, the primary coil S^1 of which is attached to terminals *f e*, Fig. 7, and the secondary coil S^2 to the terminals $T T^1$. The magneto is arranged to give alternate currents, which produce a continuous sound in the telephone. The magneto switch used in the other testing apparatus for reversing the continuous current is not required in this instrument, and, as there is no galvanometer needle, the key *K* is dispensed with. In other respects, the testing-bridge is similar to that first described.

When a test is being taken, the handle of the magneto-generator is turned by one operator, while the other holds the telephone to his ear, depresses pointer *P* and moves it over the branch resistance ring, until a point is found at which the sound is either reduced to a minimum or is altogether absent. The figure marked by the pointer then gives the actual resistance of the lightning conductor or line under measurement, without the necessity of taking the mean of several tests, as is the case when the tests are taken with continuous positive and negative currents. The polarization of the earth-plates is also neutralized by employing alternate currents. As the noise caused by the revolving armature of the magneto might interfere with the test, it is advisable to use longer leading wires than those required with the other apparatus, in order to keep the telephone as far away from the magneto as possible.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, May 2, 1887.

I find that the attention of electrical men generally is being drawn to the desirability of rendering all the various fittings and woodwork of switch-board, exchange, operating room and central station as nearly fire-proof as possible. The public is now to such an extent dependent upon electricians and electrical devices for its comfort, convenience and safety, that it does not answer to take any risks that can be fairly and properly avoided. Two things to be specially guarded against are dampness and liability to fire. To meet these enemies, one of the best things lately brought to my notice is the "P and B" paint, manufactured by the Standard Paint Company, of 59 Maiden Lane, this city. The range of application of this paint is certainly a wide one, including the metal roof and the submerged pile of an ocean wharf. It seems to be specially adapted to the protection of metal work and withstands acid and alkaline solutions very thoroughly. Mr. Paul Seiler, the well-known superintendent of the California Electrical Works, has found the paint to have high insulating properties, and considers that on an iron-armored cable it would be as serviceable as a jute covering. Mr. T. Gallagher, of the Sunset Telephone Company, San Francisco, has tried it on telephone cables, cotton-covered wires, etc., and has "found it excellent for resisting moisture, and salt water seems to have no effect on it." The Noll Brothers have been using it as "a good electrical insulator" for insulating joints, painting mouldings in damp places, etc., with the Edison system. The contractors for the Westinghouse system use it, and it was lately applied to the New York subways on the brick and iron work. Mr. Beckwith, of the Metropolitan Telephone Company, has also used it. Evidently there is good reason for using this paint in electric installations of all kinds, and I shall be very much surprised if now it has been tried and found satisfactory, it is not very extensively adopted.

Holmes, Booth & Haydens, 25 Park Place, have just issued a new and neat price list of some 50 pages. It gives details of their wires, carbons, etc., and includes no small amount of information as to electrical units, wire gauges, fire underwriters' rules, in New York and New England. An appendix to this useful little book contains the diagram of the new Edison gauge, showing number of wire and ratio between circular mils and maximum safe carrying capacity in ampères.

Robert M. Gilmour, 82 John street, New York, is making a specialty of asbestos materials, standard Russian hair felt for boiler coverings, etc., and furnishes estimates for boiler, steam and water pipes, tanks and other appurtenances of the electric light and power station.

Mr. G. L. Wiley, the active local representative of the Standard Underground Cable Co., sold last week to the Western Union Company here ten miles of 19-conductor No. 14 B. & S. aerial cable. This will be strung on one of the west-side elevated roads. He also sold them 19,100 feet of 30-conductor No. 14 B. & S. underground cable, which his company will lay in the Western Union iron-pipe subway on Broadway. The telegraph company have now had in use since last year a similar underground cable of the Standard make, of 50 wires, one mile in length, through which they have been working, with perfect satisfaction, their heavy quadruplex circuits. The test has been a severe one for the reason that the conduits lie alongside the Steam Heating Company's pipes. The results are indicated in the new orders above mentioned. Mr. Wiley says that although the factory was lately doubled, it is still kept "rushed." He moves about May 10 into the new offices in the Metropolitan Telephone building, Cortlandt street.

I was sorry to note the destruction by fire last week of the factory of the Vosburg Manufacturing Company in Brooklyn. The company is a heavy producer of gas and electric light fixtures and the fire has temporarily thrown two or three hundred workmen out of employment. The company proposes, however, soon to be ready for business again.

Mr. F. A. Magee, formerly of the Electrical Supply Company, is now with E. S. Greeley & Co.

A plant for general lighting is being put in at Tarrytown, N. Y., by Mr. C. T. Jackson, of the Hecla Electric Light Company. Dr. Roe has assigned to him the local franchise and is co-operating in the enterprise, to which the press gives a hearty welcome, speaking highly of the lights. To begin the plant, a 45-light machine, with engine, etc., has been installed at Purdy's mill, steam being taken from the boiler there.

W. H. Mueller, carbon plate manufacturer, 670 Hudson street, removes to 39 Dey street, where, as heretofore, he will make carbons of any style to order for all special and experimental purposes. Primary battery carbons are a specialty of his.

If any of your readers want to see something that is really magnificent and beautiful, let them go into the new Equitable building and see the aisles and rotunda sparkling with marble and metal, all lit up by United States lights. During the present week the building is thronged with crowds of delighted spectators.

Mr. W. Irwin Wark and Mr. C. W. Madden, of the Empire City Electric Company, 779 Broadway, are on the warpath, and will scour the hunting grounds of the new West all the way across to 'Frisco, bearing with them samples of electric light wire of all numbers, insulator pins, brackets, etc. The "Excelsior" tape they will show is taking a good position in the eyes of the trade, and is being used by some of the big companies. The new gravity drop annunciator is selling well, also their new iron box bell. The company claims also to have the best finished push buttons of its own make. It is also making a good disc Leclanché battery. A special feature just now consists in the new learners' instruments, which are in brisk demand on account of their cheapness and excellence. The company is handling all varieties of line materials and everything that pertains to the practical side of the business.

The American Manufacturing and Supply Company, 10 and 12 Dey street, who are introducing the fine self-winding clocks of the Pond patent, have secured for developing their business, the services of Mr. George W. Hunt, an engineer and electrician of large experience. Mr. Hunt is the son of Walter Hunt, who, as all know, ranks with the earliest and most celebrated inventors of the modern sewing machine, and is himself the inventor of the Globe printing press and other excellent machines of like nature. He lately brought out a system for cleaning sewers automatically, to obviate the necessity of sending men into such places, and the machine has recently been tested here quite satisfactorily.

The hearings in the McMahon *vs.* Flynn subway suit are still going on. Among the witnesses on the stand last week were Mr. T. N. Vail and General Huidekoper. It was shown to be essential to the welfare of the Metropolitan Company's telephone service that good subways should be built, and that the matter should not be rushed on the company by incompetent parties in bad shape. Speaking of the subway company, Mr. Vail said: "We would not take a direct interest, but we did take an indirect one. We wanted full opportunity to experiment." Mr. Sefton, of the Subway Company, and formerly secretary of the Subway Commission, has also been on the stand, but little was to be elicited from him in the way of substantiation of the McMahon claim for subway stock. Meantime, in the Legislature, the Subway bill has been carried to a third reading in the Assembly. It continues the present commission and confirms the contracts made by them. It is interesting to note, by the way, that the Sixth avenue conduits cost $43,000, the excavations $45,000, and the engineering about $5,000.

Over in Brooklyn the Bacon Investigating Committee has pushed its probe further into electric light matters, especially with regard to the manner in which Fire Chief Nevins came to to be interested in the companies now operating there. I mentioned last week the main points in the evidence of Mr. H. W. Pope, who told how he and his friends had been "frozen out." Mr. Pope has been on the stand again, giving evidence as to the checks paid over to Nevins, who, however, did not account for the money used. Said Mr. Pope: "We had invested our friends' and our money, and we were shut down. We either had to pay or lose. If we had not paid others would have got the franchise. We were sat down upon, and I claim it was extortion. Our first notice came from the Deputy Commissioner of the Fire Department, which said it would vitiate insurance if we strung wires. Then the underwriters stopped us. After this we saw that all resistance was useless, and we saw Mr. Nevins. The politicians were the extorters, and it originated with Mr. Nevins, who said he wanted the money for his influence in getting the thing through. He told me to ask no questions. I understood the 840 shares he had he never paid anything for." Evidence on the subject was also given by Mr. Charles Cooper, president of the Municipal Electric Light Company, and by Mr. G. H. Dunham, who had a financial interest in the matter, and who also, I may note, was interested in New York subway matters. Chief Nevins has also been examined as to the $8,500 received for securing the franchise for the company. He refused to make any explanation, but said flatly that the money was not used for corrupt purposes. It came out, casually, in the evidence, that some of the parties, including Mr. Nevins, were for a time interested in an electric gas lighting torch. It is said the committee will recommend the indictment of Mr. Nevins.

The Excelsior Electric Company, 9 Dey street, have in their Hochhausen dynamo a machine that is doing remarkably good work on arc and incandescent lighting, and with both kinds of light on the same circuit. The system is naturally attractive to the owners of stores and mills that require artificial illumination but must have pure air and pure light. The fact that the company has put up 2,000 arc lights in Brooklyn, where its factory is situated, tells a story of local esteem and confidence that cannot easily be matched.

The engine of the New York Safety Steam Power Company presents many notable points of excellence, which have already received attention in the columns of THE ELECTRICAL WORLD. Large percentages of load can be thrown on or off without perceptible effect on the governing. The crank shafts of all the engines—horizontal, etc.,—are solid hammered or wrought steel throughout in one piece. All parts are interchangeable, and all lubrication is automatic. One week recently over 2,000 h. p. of this make of engine was sold.

The company have just completed a 100 horse-power steam plant at New Rochelle to operate Thomson-Houston lights. It was started up April 30, and is a model plant in every respect. Mt. Vernon, N. Y., was lighted Saturday night, April 30, by the American system from a station established at the Water-works Pump House near Pelhamville, using a 50 h. p. high-speed engine of the New York Safety Steam Power Co.'s make. A very excellent performance was afforded the citizens on this first night. To make a dull town bright, use a perfect engine and a perfect light.

In the matter of New York City electric lighting contracts, Corporation Counsel Lacombe has decided that contracts may be awarded to companies before their plants and wires are up, but that the companies are governed by the decisions of the Subway Commission as well as by the votes of the City Council. So far, however, no action has been taken, except in the award of one contract to the United States Company for its old territory.

C. H. Pond & Company, 17 Murray street, the manufacturers of the Pond clocks, are moving to Astoria, the demand for their clocks having necessitated greater facilities for their manufacture. In a recent letter to the parent American company abovementioned, Mr. H. L. Bailey, electrician, with the Law Telephone Company, writes: "I have made careful and extended tests of your motor for efficiency, etc.; and a determination of the battery power necessary to wind your clocks for a given period. I find that two improved 'Law Prism' cells furnish sufficient power to maintain the clocks in operation for at least two years without renewal or attention of any kind whatever." W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, May 2, 1887.

The Waterhouse Electric and Manufacturing Company, of Hartford, Connecticut, is very busy on arc light orders. The plants installed are said to be giving entire satisfaction and the company may well feel pleased in receiving from its local companies such strong recommendations. The Waterhouse Company created a stir in the electrical field by the announcements it made of the little power required by its dynamo and the new and remarkable regulator it was introducing. It was doubted at first that all the claims could be sustained, but the rapid introduction of the system and the fine light produced, have given evidence of appreciation, and the system has taken rank with the best in this country, so that one is obliged to concede evidence of progress. The company is also bringing out a motor for high tension currents. I witnessed lately the working of the motor in Mr. Waterhouse's laboratory. It is entirely under control. Mr. Waterhouse makes the statement that: "The motor is self-regulating without mechanism of any kind, and will pull a constant load at any required speed from one revolution up to a thousand revolutions per minute, and it will maintain such regular speed independent of *any change in the load*. Its economy is up to the maximum point yet attained in motors." Heretofore power has been attained by driving motors at a high rate of speed, but Mr. Waterhouse has strong power running his motor at slow speed. The addition of this motor for arc currents to the Waterhouse system under such perfect control, is a valuable and desirable feature. The Waterhouse motor is ready to be placed in practical use, and orders for it are already in.

The Boston *Commercial Bulletin* is authority for the statement that "there is another electric company forming in Springfield, Mass."

Mr. Warren S. Hill, a manufacturing electrician of Boston, and well known among the electrical fraternity, is making a little dynamo for incandescent lighting, which may be appropriately termed a "wonder." It weighs less than 150 pounds, and easily produces twenty-five (16 c. p.) incandescent lights—full and clear.

At the meeting of the Newton, Mass., Common Council on Monday evening, April 26, it was voted to contract with the Newton Electric Light and Power Company for the lighting of seventy-one 1,200 candle-power arc lights at 50 cents per night for twenty nights per month, to be kept burning all night. The committee on street lights recommended giving the oil lighting contract to the same company. It was also asked that the electric light company be authorized to furnish seven hundred incandescent lights—400 of 25 c. p. and 300 of 20 c. p.—to be burned twenty nights each month from sunset to midnight, the cost of each light to be $15 a year. The contract with the electric light company is for one year, commencing June 1, 1887.

The Eastern Electric Cable Company, Boston, Mass., has enlarged its wire and cable works on Hampshire street, and by the addition of several improved braiders and other machinery its manufacturing facilities have been largely increased. Mr. A. A. Clark, the general manager of the company, is known by nearly every electric light company throughout the country, and as the inventor and original maker of the "Clark wire" he stands high in the estimation of the electrical fraternity.

The Westinghouse alternating converter system of incandescent electric lighting is to be installed at once in a section of the Hoosac Tunnel. For the present it will be merely experimental so far as lighting up a mile or two of the tunnel; and, if satisfactory, which will of course be the case, the Fitchburg Railway Company will contract with the Westinghouse company for the lighting up of the entire tunnel—the distance from end to end being $5\frac{1}{10}$ miles.

The New York Insulated Wire Company have been making some very extensive alterations at their factory in Reading, Mass., and with their new and improved machinery, now propose to offer their wires and cables at the very lowest figures that a first-class article can be sold at. The factory is now under the personal supervision of Mr. W. B. Dowse. They have removed their Boston office from 33 Oliver street to 11 Central street, and have also opened a handsome salesroom at 452 Broadway, New York, under the management of Mr. James W. Godfrey.

A special dispatch to the Boston Sunday *Herald* dated Skowhegan, Me., April 30, gives the following: The new "Boston & Quebec Air Line Railway," to be built up the Kennebec River, from Skowhegan to Moose River village—the transcontinental

junction with the Canadian Pacific and Quebec Central railroads —will develop very important electric light and motor enterprises between Waterville and this junction. At Moose River 10 electric light plants are under negotiation, which, when completed, are to furnish an amount of light equal to 1,000,000 candles. Along this distance of 100 miles are water-powers, now nearly all developed, equal to 100,000 horse-power, equivalent to 1,000 horse-power every mile. With the railroad along its entire length, the Kennebec makes one of the most wonderful water-power rivers of the world.

The Bernstein Electric Light Manufacturing Company, of Boston, is quietly but rapidly introducing its low resistance lamp among the various arc-light companies throughout the country. The Bernstein lamps are of 30, 60 and 125 candle-power, for use on arc-light circuits, and the cut-out appliances of the company's system are simple and reliable. Its 20 and 30 candle-power series lamps, for city and town lighting from central stations, are very extensively used in the West to-day.

The Citizen's Electric Light Company, of East Boston, whose station on Condor street was destroyed by fire on the morning of March 4, to which, reference has previously been made in these columns, has nearly recovered from the damage then inflicted. The new station, which is of brick, 40 x 50 feet, is about ready for the slate roof, and the engine foundations are now in position. The company expects to occupy the new station in about three weeks, and will then have an excellently appointed establishment, with a first class new plant of 125 lights, American system. The experience of this company is proof that a company with small capital, the best of modern apparatus and conservative management, can command success, even in the thinly settled suburbs of a large city, proverbially the most unfavorable situation for a lighting business.

The Schuyler Electric Manufacturing Company, of Hartford (successor to the Schuyler Electric Light Company), has completed its reorganization and is rapidly increasing its facilities for manufacture. The officials of that company claim that the irarc system is absolutely perfected by the addition of the ventilated armature and a new automatic regulator. The regulator is particularly serviceable in steadying the current for series incandescents. The company is making a specialty of the sale of series incandescents, a 25 c. p. lamp being the most sought for. Arc lighting companies have for a long time desired some economic method of burning incandescents on their regular circuits, and the "series" exactly fills the bill it is said. It is connected directly to the arc circuit without any converter, distributor or other expensive medium. Arc companies can buy in large or small lots, and many are now trying them with favorable results. The expense of outfit is trifling. The new Schuyler regulator while responding to the slighest variation in current is quick enough in action to prevent accidents from sudden changes in the circuit. Visitors to the Schuyler factory are delighted with the exhibition tests, it is stated. A favorite experiment is to place in circuit one of the series incandescents and forty-five arc lights, and to suddenly switch off all the arc lights, leaving the one incandescent alone burning in the circuit, and the machine running at full speed. This one incandescent can be left in such a position for any length of time without injury to dynamo or lamp.

A bit of suggestive reading appeared lately in an excerpt from the official proceedings of the authorities of a city which shall be known by the initial Z. Rebates in a single month were claimed by the city and allowed by the company furnishing its street lights, for lamps out an aggregate of 6,934 light-hours, and for towers out an aggregate of 104½ light hours. While other causes may have contributed to this ruinous loss, the proportion chargeable to poorly insulated conductors would in a very short time pay for an entire renewal of the line with first-class wires. Apropos to the above is the statement of the superintendent of the Malden, Mass., Electric Light Company, that during last winter, through all the storms that have severely tested the insulation of his lines, not one of his lights has been dimmed perceptibly. The Malden plant is furnished throughout with "Campbell" wires.

The New England agents of the Edison United Manufacturing Company (Messrs. Paine & Francis) have achieved such excellent results by their labors during the past season that they deserve a good deal of credit. Both gentlemen are quite young in years, but those who are acquainted with them are ready to testify to their rare business ability, enterprise and push. During the past month Messrs. Paine & Francis have installed isolated incandescent plants as follows: 400 lights in the Massachusetts Cotton Mills, at Lowell, Mass.; 50 lights at the factory of the Beacon Oil Company, East Boston; 200 lights for the Bradley Fertilizer Company, at North Weymouth, Mass.; and 50 lights on the new ferry-boat "General Hancock," running between Boston and East Boston.

The Jarvis Engineering Company, of Boston, reports the prospects for erecting electric light and power stations during the coming season as encouraging. This company is at present at work upon the Edison Electric and Illuminating Company's station (No. 1) in this city, and has already put in six Armington & Sims engines, and is to set up ten more boilers with the Jarvis setting. This station is said to be the best paying Edison central station in the world. The No. 2 Edison central station (Boston) now being erected on Bowker street, will use, it is said, when completed, twenty Armington & Sims engines and fourteen boilers set as above. The Jarvis Company are also remodeling the Edison station at Brockton, Mass., and also adding to the equipment of the electric light plants at North Attleboro, Mass., Newburyport, Mass., and Charlestown, Mass.

Some time ago, the Ludlow Manufacturing Company, Ludlow, Mass., invited several of the leading manufacturers of incandescents to make tests at its factory of their respective systems with the view of adopting one of them for lighting the enormous works of the company, covering about seven acres. After a trial test on Wednesday night, April 27, between three competing companies, it was decided to award the contract to the United Edison Manufacturing Company.

Among the prominent incandescent electric companies doing business in New England, is the Sawyer-Man Company, which has operated more or less in conjunction with the Thomson-Houston Company, and has been notably successful. About a year and a half ago this company opened a branch office at No. 4 Pearl street, under the name of the Consolidated Electric Light Company. The advantages of its apparatus, consisting in the automatic regulation of its dynamo, long life of its lamps, and their incapability to blacken, are matters of great importance, and therefore readily recognized by the public. The growth of business was beyond all expectation, and the name was changed to the Sawyer-Man Company; and owing to the increased demands for its apparatus larger quarters were leased in the Richardson Building, 178 Devonshire street, and 33 Federal, on the same floor with the Thomson-Houston Electric Company.

I have perused a number of letters from people who testify to their using the Sawyer-Man lamps over two thousand hours, and there are a number of places in the city of Boston where these lamps are run with an average of from 1,400 to 1,800 hours life. Many central stations operating arc lamps have adopted this system of lighting with success. The economy of the lamps and the long life give material advantages in the profits of the station. Most of this company's energies, however, have been bent upon the installation of isolated plants. Although at the time it first operated in New England, the number of plants under the Sawyer-Man patents did not number a dozen, hundreds of installations throughout the country now testify, not only to the popularity of the system, but also to its efficiency. The wiring of the Sawyer-Man Company is very creditable in the details of its installations. The company takes particular pains in this branch; its safety devices, while practical, are very ornamental. The New England office is in charge of Mr. P. H. Alexander, a gentleman well known in electrical circles, having had large experience in the specialty of electrical illumination.

The business of the Mather Electric Company is rapidly increasing in this section, so much so that it has found it necessary to lease more commodious and more centrally located offices for its eastern agents, Messrs. Pray & Sparrow, at No. 31 Milk street, Boston. The gentlemen named, representing as they do one of the leading electric light enterprises of New England, are entitled to attention from those who contemplate adopting either arc or incandescent lights on their premises. They are prepared also to contract for and erect complete outfits of motive power, and make a specialty of fitting up and equipping small isolated incandescent plants of 25 lights and upwards.

The Boston Electric Light Company, combining—as heretofore stated in these columns—all three of the "Hub's" former local electric light companies, moved into extensive and magnificently furnished offices, No. 17 State street, on May 2. President F. A. Gilbert and Vice-President Hugh J. O'Brien occupy room 3, which is to be used also as a directors' room. This apartment is roomy and airy, and is fitted up richly, and with everything to make a man of business feel at ease. President Gilbert understands what is requisite for a well-appointed and nicely regulated business establishment, and Mr. O'Brien, being the well-known Mayor of Boston, naturally sees that his surroundings conform with the dignity of his position—both as to the city and as to his business. Room 4 is occupied by the treasurer of the company, Col. Samuel S. Sias, who will be assisted in his important work by his young son. Room 5 is set apart as the general business office of the company, and is under the excellent management of Messrs. M. S. Lewis and F. A. Swan. The first named gentleman has charge of the arc-light department, while the latter looks after the incandescent appurtenances and equipments. The burly, irrepressible and genial Frank Ridlon, the New England agent of the Brush-Swan Company, occupies a goodly share of this office, and will contribute largely to the entertainment of those who may call. Room 6 is the quarters of the cashier and book-keeper—Messrs. T. C. Daniels and C. F. Cook. The Boston Electric Light Company is deserving of congratulations from its friends and patrons for its acquirement of such pleasant, cozy and conveniently located offices. It must also be kept in mind that there is no parent or local electric light company in New England or elsewhere that has a more efficient or courteous general superintendent than has the Boston Electric Light Company in Mr. P. Fahey.

Installations on the Sun Electric Company's induction system are increasing in number daily, and give good satisfaction. As one instance of this, it is stated that in Boston, where some hundreds of lamps are now being operated on this plan, not a lamp had given out within the first 500 hours, and the other parts of the system are, so far as can be learned, equally satisfactory. No accident has occurred to any of the dynamos or converters. The Boston plant is being extended, and the capacity at Bridgeport is shortly to be doubled. At Woburn, where the factory of the company is situated, numerous dwellings and stores are lighted on this Sun system, this applying naturally to instances in which the distance from the central station is too great for low-tension supply.

I understand that the Sun Company are about to install a considerable plant in Philadelphia. One feature of the system employed by the company is the better regulation of the incandescence of the lamps under variations in the number in operation, and the converters are free from annoying humming or buzzing.

The Electrical and Mechanical Exhibition, held at the Skating Rink, Worcester, Mass., during the past month, closed last Saturday night.

Mr. A. F. Upton, general manager of the Jarvis Engineering Company, Boston, who sailed for Savannah the latter part of last week, will be absent about three weeks on a business trip in the interests of his company to the principal cities and towns in Georgia, Alabama and South Carolina. Mr. Upton is certain to meet with a kind reception from business men he may meet on his journey.

Messrs. Roland T. Oakes & Co. have established themselves in the electrical business at Holyoke, Mass., and will also contract for the installation of electric light plants and for fitting up buildings with electrical apparatus of all kinds.

It is rumored that the Bernstein Electric Light Manufacturing Company, of Boston, contemplates presenting to the trade some very important developments in incandescent lighting at an early day. It is a well-established fact that the company has a good lamp; and it is only fair to say that whatever new may be presented will merit attention.

A report comes from Waterbury, Conn., that the Scoville Manufacturing Company, of that place, has entered extensively into preparations for producing silicate cored copper wire for telephone and telegraph purposes. Competent judges pronounce this wire as having a greater tensile strength than solid copper wire, and nearly as much conductivity; but at the same time they predict that the cost will be greater than with the other. It is said, however, that the Scoville Company has promised to put the product on the market at about the same price as ordinary copper wire.

Messrs. James Hunter & Sons, of North Adams, Mass., are steadily extending their acquaintance, and rapidly enlarging their business dealings with the electric light companies, not only throughout this country, but also in Canada and Europe. The simplicity, durability and cheapness of the patent friction clutch manufactured by this firm deserves attention from electric light people, who use shafting in their stations or plants.

President Leopold Schlegelmilch, of the Schaefer Electric Manufacturing Company, of Cambridgeport, Mass., reports a greater demand at present for his company's lamps than has occurred at any time during the past year; and he attributes this principally to the attractive display recently given by his company at the Worcester Electrical and Mechanical Exhibition.

A large number of users of incandescent lamps in Boston are beginning to appreciate the advantages of the Wheeler reflectors. Some of those who have been using these reflectors for months allege that the effectiveness in illumination of their incandescent lamps is increased thereby fully 25 per cent.

A new organization is to be started in Fall River for manufacture under a patent which Mr. John Beattie, Jr., of Westport, has obtained upon a recent invention. The capital stock of the new concern has been fixed at $100,000, for which a considerable amount has already been subscribed. Mr. Beattie has discovered a process for combining mercury and zinc. Plates such as are used by telegraph companies and in electrical appliances are to be manufactured, and the invention is regarded as a very valuable one. Electricians in New York are also said to be interested in the project. You gave recently some details of Mr. Beattie's work.

The Union Hardware Company, of Torrington, Conn., was almost unknown to the electrical trade eighteen months ago; but to-day it numbers among its patrons the majority of the dealers in electrical goods and handlers of electric supplies. The various grades and numerous shapes of push buttons—made in every known wood—manufactured by this old and reliable company have found a market in every section of this country.

Messrs. Blodgett Brothers & Co., of Boston, make a specialty of annunciators; in fact, they may be appropriately termed "old reliables" in this particular line—a title justly gained by a great many years of painstaking labor on the kind of goods referred to. In a communication I recently received from the Messrs. Blodgett, they say: "We are building many annunciators this Spring, and some of the best houses in the country are ordering from us. During the last week of April we have had calls for more than 30 annunciators, many of them with over 100 drops."

The National Pipe Bending Company, of New Haven, is engaged in a very large and profitable business with the electric light companies and manufacturers in all sections of the country. The National feed water heater manufactured by this company has a familiar sound to the ear of every user of steam from Maine to Texas, and New York to California; and a very large percentage of the feed water heaters now used are said to be of the make just named. This company also does a very large business in pipe bending.

Mr. E. C. Perkins, of Providence, R. I., is not only an expert in the electrical line, but is one of the most genial and entertaining gentlemen in the trade. My friends in "Little Rhody" who contemplate having their factories, stores or residences wired for incandescent electric lighting, electric gas lighting apparatus, burglar-alarms or annunciators will find it to their interest to consult with Mr. Perkins, regarding plans and estimates on that class of modern improvements. Mr. Perkins has for several years past acted in the capacity of general agent for Rhode Island for the Boston Electric Company.

The Jarvis Engineering Company, of Boston, has made the following sales recently: 125 horse-power Armington & Sims engine to the Consolidated Electric Light Company, of Portland, Me.—the seventh engine of this make in use there; a 60 h. p. Armington & Sims engine to the New Haven Electric Light Company—the ninth of this make in use there; a 60 h. p. Armington & Sims engine to Warner Brothers, Bridgeport, Conn.; and a 70 h. p. engine of same make to the Northampton Electric Light Company. The Jarvis Company is also rapidly increasing its business dealings with the manufacturing interests. For instance, it recently set thirteen boilers at the mills of the Warren Manufacturing Company, Warren, R. I., and is at present engaged on large contracts for the Suffolk Cordage Company, of Chelsea, Mass., and for the Woburn Water-Works, at Woburn, Mass.

The Electric Gas Lighting Company of Boston has just issued a series of new circulars giving separate description—in addition to catalogue—of a number of the leading specialties for which this enterprising concern has won a widespread reputation.

The R. I. Telephone and Electric Company, of Providence, R. I., merits notice for the enterprise it has evinced in placing upon the market a line of electrical goods which command favorable criticism and patronage from the trade. Most conspicuous among the manufactures of this company is the "Little Giant" battery, which has become a staple and popular adjunct to the general electrical supply line. This company also has the exclusive manufacturing privilege for the Wright aerial cable clip, so extensively used among the telephone and telegraph companies for swinging cables. The company also manufactures cut-outs for the protection of telephone and telegraph offices against lightning.

The electrical freight railway recently installed by the Sprague Company (N. E. agents, Messrs. Sawyer & Blake) in the yards of the Boston Sugar Refining Company in East Boston, is now in successful operation daily, and attracting a good deal of attention among the manufacturing interests in this section. There is 700 feet of track, the motor, 10 h. p., running two cars carrying 4½ tons each, applied to the driving axle of the car by an arrangement of the gearing peculiar to the Sprague system. The current operating the road is generated at the refining house by a 150-light Edison dynamo used also at night for lighting the premises. The current is conducted to the motor by an overhead trolley line. The circuit is returned to the dynamo by means of the rails, which are re-enforced by copper wire connections. The car is operated by a single switch, which is used for starting, stopping or reversing. The simplicity and compactness of the apparatus named is admi

rable, and again demonstrates the practicability of electric motive power for railway as well as other purposes.

Conspicuous in this section among the many successful enterprises identified with electric lighting and power has been the New England Wiring Company of Boston, recently reorganized under the name of the New England Wiring and Construction Company. In a recent interview with Mr. Walter J. Paine, the manager of the company, the following points were elicited: This company, originally known as the Brockton Wiring Company, was organized under its present management in 1883, in Brockton, Mass., its first installation of a central station being for the Edison Company in that city. The work was creditable and very satisfactory to the Edison company, so much so that it won the young enterprise a reputation for doing excellent work, and gained for them a permanent patron in the parent company just named. Orders came rushing in from other and unexpected sources, and it was found necessary to move to larger and more centrally located offices. In April, 1884, an office was leased on Pemberton Square, Boston, and on entering the new quarters the company's name was changed to the New England Wiring Company. One year afterward the company again removed to still more commodious offices at No. 105 Summer street, and at this time it purchased the Edison Company's New England construction department for isolated lighting. Since then it has attended to the construction work and the installation of the central stations in New England of the company named. In order to provide better facilities for its rapidly increasing business, the progressive young company again re-organized as the New England Wiring and Construction Company, as stated above, and having increased its capital and working facilities it again removed to extensive and magnificent offices in the new building of the Boston *Globe*. The company will retain, however, its old quarters on Summer street, which are to be used as work shops and store rooms in connection with its business.

The business operations of the Thomson-Houston Electric Company of Boston during the past twelve months again exhibit a marked improvement over those of the preceding year. To-day the company is enabled to promptly fill orders for either of its arc or incandescent apparatus, owing to the recent enlargement of its factory building in Lynn, the increase of its manufacturing facilities, and the employment of an additional force of expert electricians and skilled mechanics. A glance over the files of THE ELECTRICAL WORLD during the past quarter will give the reader an idea of the popularity of the Thomson-Houston systems in various sections of the country and abroad. Scarcely more than a year ago the company occupied three small rooms as its executive office at No. 131 Devonshire street, and the business was conducted by the manager and secretary, assisted by one book-keeper, two assistant clerks, one lady stenographer and one boy. To-day the Boston offices of the company at 178 Devonshire street take up a series of large rooms, occupying an entire floor of the Richardson Building. Here the officers of the company, Messrs. Pevear, Coffin, Barton and Garfield, have separate departments, and give their individual attention respectively to some particular branch of the business, assisted by a large force of employés. The arrangement of the different departments shows good management and perfect discipline. In addition to the officers and employés above referred to, the company have from three to five gentlemen constantly at hand to receive and attend to customers and callers. There are also branch offices in Chicago and Philadelphia. The weekly pay-roll of the company has more than quadrupled since a year ago to-day. The increase in the number of the company's employés at the Lynn factory is in itself remarkable. In the spring of 1886 the number of people employed was about 325, including the superintendent and several foremen; while at the present time upward of 700 people find steady employment within the walls of the enormous factory building.

On the 1st of January, 1883, there were probably less than 000 of the arc lights made by the Thomson-Houston Company n this country. During the year 1883 about 3,000 lights were manufactured and distributed in various parts of the country, and its business has rapidly increased, so that during 1886 it manufactured and sent all over the world over 12,000 arc lamps, besides a large quantity of incandescent apparatus. To-day there are between 30,000 and 40,000 of its arc lights in operation, and while the company has done a great business in equipping factories, car shops, foundries, commercial houses, etc., with isolated plants, it has accomplished even more important work by the formation all over the country of local electric lighting corporations; of these there are now organized and doing a successful business under its system more than 200 in various parts of the United States. In addition to this, it has established plants in Central America, Peru, Brazil, Honolulu, Sweden, England and other countries.

The Wainwright Manufacturing Company, 65 and 67 Oliver street, Boston, report the following sales of their corrugated feed-water heaters during the month of April: 2 in Boston, 2 in Bridgeport, Ct.; 4 in New York city, and one each in Natick, New Bedford, Mass.; New Rochelle, N. Y., and Waterbury and Plainville, Ct. Their sales in their other specialties have also been satisfactory, and are increasing daily.

At the meeting of the Boston Scientific Society on April 26, Mr. A. V. Garratt read an interesting paper on the theory and development of the dynamo. He covered the ground traversed by all the early experimenters and investigators and came down to date. Mr. Garratt used the lantern to illustrate his lecture. He projected on the screen a diagram of a theoretically simple dynamo and explained how its various parts performed their various functions. He also described and illustrated the theory of magnetic lead and the diameter of commutation, and the various devices for determining the correct position of the brushes and the manner of making them automatically assume this position. Then he showed a series of thirty slides on the screen of typical dynamos, beginning with the little Pixii machine built on Faraday's specifications, down to the great 500 horse-power Brush dynamo, for use in the Cowles process. The thirty slides comprised all of the best recognized machines made in Europe and this country.

The Electric Gas Lighting Company, 35 Arch street, this city, has just issued a new circular regarding its automatic gas burner and electric gas lighting apparatus in general. Some interesting details are given about the "single magnet" ratchet automatic, and a number of striking testimonials are quoted as to the efficiency of its operation.

The American Conduit Company has been given rights to do business, by the Boston Aldermen, over the veto of Mayor O'Brien.

The Boston *Globe* opened on May Day its splendid new seven-story building on Washington and Devonshire streets. The ornamentation throughout is rich and tasteful. Of course the electric light is used, and the fixtures are unique in design as well as beautiful in finish. THE ELECTRICAL WORLD was glad to be counted among the guests of the occasion. After the inspection of the building and newspaper offices, a collation was served.

The Standard Electric Time Company, recently formed in Waterbury, Conn., have located their general manager's office in the Yale Bank Building, in New Haven. This company absorbed the Electric Time Company of Waterbury, who, after an investigation, adopted the Warner system of electric time, of which Mr. C. D. Warner, of Ansonia, Ct., is the patentee. The company were so well-pleased with the successful working of this system that a parent company was proposed, and organized with Mr. John W. Hill as president, and Mr. Warner as general manager. They say that business is booming, and the prospects are good. A large plant is now being put in New Haven, and plants in other cities are to be operated as soon as apparatus and clocks can be manufactured. They make a great variety. This system is composed of a master regulator, with a general distributing switch-board at a central station, with indicators for each circuit and an electric gauge. Their illuminated electric clock is selling well, being lighted with incandescent lamps. A calendar electric clock is among their specialties. They also make synchronized clocks.

Mr. W. E. Stow, electrician, Woonsocket, R. I., was lately presented with an elegant gold-headed cane by the electric light people as a token of their appreciation. W. I. B.

FALL RIVER, April 27, 1887.

Fall River is an enterprising town of 80,000 inhabitants, mostly of the gentler sex, interested in the fifty-four extensive cotton weaving mills located here, and which contain one-third of the total number of spindles in the United States. The cotton industry is our greatest pride, but the rum trade is second on the list, while the electric light comes in on a close third. Fall River is just over the line from Rhode Island, and has proved a great boon to the thirsty sons of that cold-water State; but now, alas for them! *our* worthy citizens have voted "no license," and the dealers in spirits will either be obliged to go into the drug business or move to a more congenial clime. The number of lamps now run from the Edison plant, Mr. E. W. Hammer, manager, is about 30 per cent. greater than on the same date one year ago, and the business is booming to such an extent that an increased plant will shortly be needed. It may perhaps be interesting to note that eleven mills in the city are lit from Edison plants aggregating 4,500 16 c. p. lamps, and all are running very satisfactorily. We are likewise going deeply into the transmission of power, believing thoroughly in the large money possibilities connected therewith. J. H. Franklin & Co., one of Fall River's most enterprising printers, are just about moving into new and commodious quarters where the plant will be run by a Sprague motor. The electrical outlook is at present very rosy.

PHILADELPHIA NOTES.

PHILADELPHIA, Pa., May 2, 1887.

There is a growing demand for electric lights all over the city. Councils have been as liberal as city finances allowed. Petitions are pouring in for additions, and no doubt the demands that are reasonable will be complied with.

It will be remembered that councils granted exclusive permission to the Penn Electric Light Company to lay underground conduits. The Keystone Company have appealed the matter to the Legislature. A bill has been introduced allowing *any* electric company to lay its conduits, subject only to such restrictions of councils as would prevent the interference of other subterranean structures, and would require the restoration of the streets to their original condition. The matter will come to a contest this week. The sum of $14,000 is to be expended in extending the electric light system on Broad street, north of Market. Electric lights are to be erected on Front street, between South and Vine streets, the limits of the old city, and the chiefs of the Electrical and Highway Departments have been directed to render all the aid they can. A bill has been passed to third reading in the Senate limiting the charge of telephones in Philadelphia to $2.50 per month. The telephonic service in this city could be doubled by a moderate reduction in charges, but it won't stand that.

An electric light company at Doylestown is now canvassing the town for consumers of light. The price fixed for one ten-candle-power lamp, one month, for house use, is $1; for commercial purposes, to burn until 10 o'clock, 80 cents, and to burn until midnight, $1.

Our new Electric Club is making a mark. Its membership represents the very best elements of the craft or profession, and deep interest is felt and exhibited in all club matters. Papers were read on Saturday evening at the Board of Trade rooms by Mr. M. D. Law, of the Brush Electric Light Company, and by Mr. C. M. Knapp, chief operator of the Baltimore & Ohio service. An excellent musical programme was a feature of the occasion. Several important papers are in preparation for future meetings. The club is in an excellent condition.

The Edgerton Company expects to make a public trial this week of its motor.

Speaking of motors, the Keeley motor is to "mote" for sure in "thirty or sixty days" this time. Philadelphians have become so accustomed to these "thirty or sixty days" promises that they smile and whisper softly, "chestnuts."

The demand for small electrical appliances is heavy and it is only old news to say that all our supply shops and houses are busy, only some more so, and a few are running on specialties until nine or ten o'clock.

Machinery and appliances of one kind or another are being added by several. The prospects are excellent for a busy year and orders for work are coming in every day.

Business in general is excellent and we are recovering from the depression caused by unsettled railway rates. Pennsylvania deals so largely in weighty materials, such as iron, steel, lumber, coal, petroleum, iron ore, etc., that it feels the effects of unsettled freight rates acutely, and then, some of her products go long distances. The industries throughout the State are all on full time and labor, as a rule, is satisfied. The only threatened disturbance is that of a strike among upwards of 100,000 anthracite coal miners. This would be deplorable, and all hope it may be averted.

D.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, April 30, 1887.

The Thomson-Houston Company is doing a heavy business from its Chicago office, and the experts of the concern are kept pretty busy figuring on new installations. The following are a few plants lately installed by them:

Watertown, Dakota	30 arc.
Bismarck, "	60 "
" "	500 incan.
Dodge City, Kansas	600 "
Chicago, Ill	200 "

They have installed a 45 arc light plant in Atwood & Company's clothing store, Chicago, and have also just closed with the Old Dominion Electric Light Company, of Richmond, Va., for 140 arc lights.

The Western Electric Company have just sold a 30-light arc plant to Roodhouse, Ill., and another plant of the same capacity to go to Salina, Kansas.

Mr. W. H. McKinlock, Secretary of the Central Electric Company, informs me that business with them is starting off even more briskly than they expected. They find not only quite a local demand for their goods, but the outside orders are already beginning to come in.

The Electrical Supply Company, 171 Randolph street, seem to be determined to keep up with the times in all matters electrical. They have just obtained the western agency of the telemeter system, by means of which an indication of the temperature of a thermometer, the pressure of a steam gauge or barometer, the height of water in reservoirs, rivers, tanks, etc., can be electrically and incessantly transmitted to a receiver, which may be located at any distance from the transmitter.

A recording tele-thermometer is in practical operation at the Electrical Supply Co.'s salesrooms, indicating and recording the changes of outside temperature at any minute or hour of the day or week. The Electrical Supply Co. have also installed some of these instruments at the following places:

Armour & Co., chill rooms	2 tele-thermometers.
Armour Glue Works, cold-air room	1 "
Board of Trade, outside	1 "
Wm. Silberhorn, lard tanks	1 tele-manometer.
L. C. Huck Malting Co., malt kiln	1 tele-thermometer.
" " " air-duct	1 "
Geo. Bullen & Co., malt kilns	2 "

All of the above instruments have given entire satisfaction, and I think there will be a large demand for them.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$155@$157
Central Union	50@ 51
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Michigan	74@ 75
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

W. A. K.

THE TELEGRAPH.

Western Union Stock.—The governors of the Stock Exchange have voted to list the new Western Union stock of $1,200,000, making the entire listed capital now $81,200,000.

T. M. B. A.—Assessment No. 206 for May is to meet the death claims of F. W. Bendel and G. H. Grace. The association now has 3,213 members in good standing in the first division and 430 in the second. Secretary Bruch is doing well.

Typewriter Telegraphs.—Mr. J. F. McLaughlin, of Philadelphia, whose ingenious electro-pneumatic tube system we described and illustrated recently, has now brought to a notable degree of perfection a system for using the typewriter directly for telegraph purposes. When the typewriter is not in use on the circuit it can be switched out and put to ordinary office work. Anyone able to operate the typewriter can telegraph, it is said, by this system.

Telegraphic Train Orders.—The General Time Convention at its meeting in this city on April 14, adopted provisionally a code of rules for the movement of trains by telegraphic orders, and the *Railroad Gazette* says that the next general change of time (May 15) will probably see the enforcement of the whole code on a large number of roads. The final adoption of the telegraph rules and forms will probably be made at the convention in October, 1887.

Not Cheaper than Gould's Line.—In announcing the combination formed by the Postal, Baltimore & Ohio and United Lines Telegraph companies for the purpose of establishing through telegraphic communication to California in competition with the Western Union, it has been announced that the rate by the combined lines would be one-third cheaper than that of Jay Gould's company. This is incorrect. The Western Union San Francisco rate was reduced to $1—the rate adopted by the combination—three years ago, and has since been maintained at that figure.

THE TELEPHONE.

Illinois.—Some of the Solons of the Illinois Legislature are again active in the endeavor to cut down telephone rates.

New York Rates.—The low rate telephone bill has been killed in the Legislature, but the public, at its own expense, is to be treated to a telephonic investigation by a committee, in the usual manner.

On to Yonkers.—The temporary injunction which W. E. Dodge, Stokes and other property owners in West Seventy-third

street, between West End avenue and the Grand Boulevard, got against the Metropolitan Telegraph and Telephone Company, restraining it from erecting or maintaining poles and wires in the street opposite to their property, has been dissolved by Judge Donohue, and the company can now go on and perfect its line to Yonkers.

A Telephone Syndicate.—A special dispatch from San Francisco says: "Among the passengers on the steamer 'San Pablo,' which sailed hence yesterday for Hong Kong, were Count Eugene Stanislaw Mitkilaiz, an electrician, of Washington; S. A. Hern, capitalist, of Philadelphia, and E. T. Barberie, of New York. They represent the syndicate to which the Chinese government has granted the exclusive privilege of using the telephone in China for thirty years." Another member of the party has proceeded by way of the Mediterranean—Mr. F. B. Rae, who has just sent home his friends a neat little "amateur" photograph of Malta, taken from the deck of the steamer.

THE ELECTRIC LIGHT.

Port Townsend, W. T., is to have an electric light plant.

Oswego, N. Y., is to have an electric light plant put in by H. Billings and others.

Latrobe, Pa.—The central station at Latrobe, Pa., will supply 700 Brush-Swan incandescent lights.

Monmouth, Ill.—An electric light plant is to be started at Monmouth by Mr. W. B. Young and others.

The Ball Electric Light Company moves into the new Telephone Building in Cortlandt street, this city.

Pueblo, Col.—The Pueblo Gas and Electric Light Company will make extensive additions to its electric light plant.

Philadelphia.—The Underground Electric Light & Power Company is to operate 2,500 Brush-Swan incandescent lights.

Tarrytown, N. Y.—The Hecla Company are putting in a plant at Tarrytown. Some details are given in our New York Notes.

Belgium.—The Gaulard-Gibbs system, known as the "Westinghouse alternating" in this country, is to be extensively introduced in Belgium.

Hiawatha, Kan.—The Hiawatha Electric Light Company has been incorporated by J. Schilling and others, with a capital stock of $20,000.

Newburyport, Mass.—The Newburyport, Mass., Electric Light Company has bought a 90 h. p. engine from G. A. Rollins & Co., of Nashua, N. H.

St. Louis, Mo.—The St. Louis Investment Co., to do electric lighting, etc., has been formed by D. B. Gould and others with a capital stock of $30,000.

Woodbury, N. J.—The Thomson-Houston Electric Light, Heat and Power Company, of Woodbury, has been incorporated by C. O. Baird and others. It is said the capital stock is as much as $250,000.

Milan, Italy.—Mr. J. W. Lieb, of Milan, writes us that the plans to light that city with the Gaulard-Gibbs system have been abandoned, and that the Zipernowski-Deri is to be tried for the same work.

Brookline, Mass.—The selectmen have reported themselves as well pleased with the arc lights they are using for town purposes. They are 1,200 c. p., at 50 cents per light per night, on one year contract.

New York City.—The United States Illuminating Company was awarded, last week, the contract for lighting its old district at $182.50 per lamp per year. No other awards were made at the time, and new proposals will be advertised for.

Kingston, N. Y.—Mr. E. G. Bernard, agent for the Sawyer-Man Company, has sold a 50-light incandescent plant to the Kingston *Leader*. He has also just sold a 75-light plant to Saxton & Thompson, Troy, N. Y., for their mill at Lockport.

A Railroad Men's Palace.—The magnificent new reading room, gymnasium, etc., in this city, given by Mr. Vanderbilt to the New York Central Railway employés, is lighted by electricity and has electric bells and other similar apparatus.

London, Eng.—The American Exhibition and Buffalo Bill's wonderfully interesting Wild West Show will be lighted by 15 Brush arcs of 4,000 c. p., 200 Thomson-Houston and 100 American (Wood) arcs, and there will also be 1,500 incandescents in use.

Victoria, B. C.—The Victoria Electric Illuminating Company's station, on the Edison system, has now been running sixty days with perfect success. The dynamos were built in Montreal. The plant is used for indoor and household lighting. There is also a station with two Brush and two Sperry machines for street lighting.

Mrs. Hopkins' House.—Mrs. Mark Hopkins has just finished her country house at Great Barrington, Mass. It has cost $2,000,000. It is lit throughout by electricity, and special effects are obtained in the disposition of the lights. Some of the lights shine through friezes of Mexican onyx.

Greensburg, Kan.—The Greensburg Electric Light Company, which organized lately, with a capital stock of $100,000, has not yet closed any definite arrangements as to its plant. Mr. C. W. Myers, who is one of those prominently connected with the enterprise, is cashier of the Bank of Greensburg.

Seattle, W. T.—As a young Western town Seattle is doing pretty well in the electric light line. There is an American station, an Edison station, and a station with Edison machines for street incandescent lighting and Sperry and Brush machines for street and commercial purposes. The last-named station is increasing its engine capacity very largely.

The River & Rail Electric Light Company, G. L. Wright, Manager, has taken offices in the new Aldrich Building on Broadway. The company is developing the new Mesrole-Main storage battery recently described in our columns, and for which a 3-volt E. M. F. is claimed. It is also at work on a new motor, shortly to be put on the market.

Harlem, N. Y.—The Harlem Lighting Company, A. L. Soulard, president, using the Waterhouse system, reports prosperity, satisfaction and progress. The plant has just been increased to 270 arcs, with power for 700, and it is expected to run up to 1,000 arcs within a year. The light shows up very nicely on the Harlem streets, and elicits many flattering comments.

Palestine, Tex.—The Edison Illuminating Company of Palestine, Tex., has been in successful operation since May 1, 1886, supplying 300 16 c. p. lights in the business portion of the town. It has now made arrangements, through Mr. T. F. Cronise, to increase the plant to 1,000 lights, to be installed within the ensuing 60 days, and to supersede all other means of illumination now in use there.

St. Louis, Mo.—The Guernsey-Scudder Company, of St. Louis, becomes the Excelsior Electric Company, of that city, with offices in the Parker-Ritter building there. The officers are: J. A. Parker, president; C. F. Parker, vice-president and general manager; directors, the above and G. W. Parker, D. Tredway and S. N. Taylor. Mr. C. J. Reilly is the superintending electrician. The plant is in the Hoyle Building.

Nyack, N. Y.—The organization of the Nyack Electric Light and Power Company has been completed, and the villages of Nyack and South Nyack will be lighted by electricity by July 1. The following officers for the company have been chosen: President, Clarence Lexow; Vice-President, Gen. James H. Blauvelt. Treasurer, Charles A. Chapman; Secretary, Harry G. Newton; The capital stock of the company is $20,000.

Carlyle, Ill.—The Carlyle Water, Light & Power Company, recently organized with a capital stock of $20,000, has made a contract with the Water, Light & Power Company of St. Louis, by which the latter is to make the water mains leading over the city. It is intended by the same company to put in electric lights shortly, and to furnish power for a number of manufacturing establishments. Various important enterprises are also in hand. Mr. J. J. Randall is the superintendent.

New Brush Plants.—The Brush Electric Company has had a number of new local lighting companies to organize lately, the principal ones being those at Fayetteville, N. C.; Asheville, N. C.; Winston, N. C.; Decatur, Ala.; Huntsville, Ala. (gas company); Dexter, Me.; Waverly, N. Y.; Garrettsville, O.; Knoxville, Ia.; Rock Springs, Wyo. Gas companies at Marysville, Cal., and Cairo, Ill., have also taken plants. Lafayette, Ind., Brush station has increased lately 200 arcs for city lighting and 450 incandescents.

Ball Lights for New York.—The Ball Electrical Illuminating Company wants a franchise for city lighting. Ex-Judge Samuel Ashton is president and Michael Crane secretary. It proposes to erect poles and wires throughout the city, also to furnish lights at 25 cents a night for each lamp, which is about one-half the amount now paid by the city. The Ball Company further proposes, in consideration of the franchise, to furnish the city on its route one free lamp for every five of private consumers on its books.

City of Mexico.—A special dispatch of April 22 says: The Colon plaza was filled almost to suffocation last night to witness something never before attempted—bull-fighting by electric light. The elite of the city were present. Ten electric lights flooded the arena with a dazzling brightness, and the question whether the bulls would fight under the circumstances was soon settled in the affirmative. Exciting sport followed. Five bulls, four of which made gallant fights, were soon dispatched by the swordsmen, and four horses killed and several torn and wounded. Two of the swordsmen and several matadores were injured.

Train Lighting in New England.—One of the most successful installations of electric lights is that started on the Boston & Albany Railroad. It uses the Julien system of batteries, and each car has twenty-four incandescent lamps, including two outside ones on each platform. It uses sixteen batteries, and after being charged they run from fourteen to sixteen hours. The success of this system is so satisfactory the railroad intends to erect a power plant this fall and use the waste cinders from locomotives for fuel. In a few years electric lights will be used on every railroad as a matter of safety. In case of accident if the lamps are broken the light goes out, and in no case can it set a car on fire.—*Boston Journal of Commerce.*

St. Paul, Minn.—The Edison Electric Light & Power Company of St. Paul, organized a few weeks ago, has the following officers and directors: Almon F. Rockwell, President; Harris Richardson, Vice-President; Donnell Rockwell, Secretary and Treasurer; and Messrs. S. A. Crozer and W. N. Morgan. The capital stock is $40 0,000. The plant will be one of about 15,000 lights, 10 c. p. basis, with all underground wires. The capital has all been subscribed, the ground purchased for the buildings, and the usual steps taken to further the objects of the company. The plant will be in active operation in a few months.

Mexico, Mo.—The Mexico, Mo., Electric Light and Power Company was organized at the beginning of April, with a capital stock of $10,000. Mr. J. F. Llewellyn is the president. The company is doing public and private lighting, and expects to do steam heating and sell current for motors. It has a 200-light United States long-distance incandescent dynamo and two 25-light Schuyler arc machines. The station contains an engine and dynamo room, 31 × 60, and a boiler room, 26 × 50, both brick. It has two 25 and one 10 h. p. Westinghouse engines and two steel tubular boilers, 54 × 12. It will shortly have another Westinghouse engine of 35 h. p.

Clutches in Electric Light Stations.—The Brush Electric Lighting Company, Cleveland, is now using Hill friction clutch pulleys up to 1,600 h. p. The pulleys have been running a year and a half. The pulleys run up to 500 h. p. The Thomson-Houston plant in Cleveland has 13 Hill clutches, ranging from 25 up to 150 h. p. each. The Allegheny County Electric Lighting Company, of Pittsburgh, have 17 or 18 large friction clutches, some of a capacity of 170 h. p. These pulleys are made, it may be noted, by the Hill Clutch Works, of Cleveland. The Works have also fitted up a number of plants for E. P. Allis & Co., of Milwaukee, and for several lighting companies in various parts of the country.

Charlestown, Mass.—The Charlestown Gas Company has written a letter to the Brush Electric Company with regard to its Brush plant plant it has in operation. The company has a 60 h. p. engine belted direct on two Brush 30 lighters, costing for coke from $2 to $2½ per run of 13 hours. On this basis "a handsome profit" is made, and it is said: "The Brush system has worked admirably, and both practically and financially its adoption has proved a most judicious and profitable investment and undertaking." The company is now erecting a substantial brick building for four 60 h. p. engines and eight 30-light Brush dynamos. This is a very emphatic commendation from all points of view, and must surely carry its lesson and have its weight.

Halifax, N. S.—A dispatch from Halifax, dated May 1, reports as follows: The Halifax Gas Light Company, through its general manager, Mr. Robert Baxter, has ordered a complete electric lighting plant, and will soon furnish electric lights or gas, as the patrons prefer. The Halifax Gas Light Company is one of the oldest, richest and most conservative in the Dominion, and this move on its part is suggestive. Before taking this step Mr. Baxter made exhaustive tests and thorough personal examination of the various systems of electric lighting, and adopted the American as the best. Mr. W. J. Morrison, Manager of the American Electric Construction Company, of Toronto, Can., has been in town the past week, attending to the details of the order. He left for the States yesterday.

APPLICATIONS OF POWER.

Harrisburg, Pa.—The electric street railroad, 3½ miles in length, to be built from Harrisburg to Steelton, Pa., is on the Van Depoele system, like the line now in operation in Scranton.

Ansonia, Conn.—The Van Depoele Company has the contract for the electric railway to be built connecting Ansonia, Birmingham and Derby, and to be driven by water-power. The road will be 3½ miles long, and will carry freight as well as passengers.

The De Bausset Balloon.—The Chicago *Herald* has lately published an interesting article on balloons, and in particular the De Bausset balloon, which employs electricity as a motive power. The system is now in the hands of the Transcontinental Aërial Navigation Company, in Chicago.

Worcester, Mass.—The Worcester Exhibition, which has been operated by means of Daft motors as the driving power, current being transmitted from the Worcester power station, has just come to a close. It has been highly successful, and has won for the electric motor a great many new friends and customers.

Brush Motors in Demand.—The Brush Electric Company reports great activity in its motor business, orders coming in every day for large equipments. One day recently orders were received for 9 motors, aggregating 100 h. p., besides the driving generators. Wichita, Kan, has taken six 15 h. p. Brush motors and two 50 h. p. generators.

The Sprague Electric Railway and Motor Co. report that they are doing an immense business in their stationary motors. On Monday of this week they had orders ahead for one hundred and seven motors, averaging above five horse-power each. They received orders for nineteen large motors in one day, coming from all parts of the United States, and are shipping large numbers to Europe.

The Waterhouse Motor.—Our New England correspondent in his letter on another page calls attention to the electric motor just brought out by the Waterhouse Electric and Manufacturing Company of Hartford. Our correspondent, who has seen it in operation, predicts that it will create a sensation in electrical circles by its performance. If it only "takes after" the company's dynamo, it will certainly be a very efficient piece of electrical machinery. The motor is now being put on the market.

Los Angeles, Cal.—Mr. R. A. Brown, an old electrician no longer in the business, residing at Los Angeles, writes us: "The Pico street Daft electric road here is in successful operation. I rode on it Sunday last, and it worked to a charm. The car starts and stops without any jar whatever, and in this respect it is much different from cable and other systems. I also inspected the engine-house and was surprised to find the machinery in use so small and so inexpensive. I was under the impression that the expense of the station, plant, etc., would eat up the profits, but in that I am agreeably disappointed."

Boston, Mass.—Among the recent power installations in Boston made by Messrs. Sawyer & Blake, New England agents of the Sprague Electric Railway and Motor Company, are the following, viz.: Manufacturers National Bank, a 10 h. p. motor for running freight elevator; Mr. W. B. Crocker's store, Washington street, 10 h. p. motor for running elevator; Mr. J. N. Duval's store, No. 531 Washington street, 2 h. p. motor for running sewing machines. Messrs. Sawyer & Blake report also a rapidly growing demand for the Sprague motor in other sections of New England.

Electric Car in St. Louis.—The St. Louis *Republican* of April 28 says: At 11:45 last night car No. 89, run by the Julien electric motor and storage batteries, left the stables of the Lindell Railway Company and ran to Third street, returned and continued out to Garrison avenue. It then curved gracefully and easily and sped back east toward the stables at the rate of twenty miles an hour, and when approaching the stable checked up successfully in one block. It then pulled out again and ran down to Fourteenth street, and on the return trip between there and Seventeenth street tried three rates of speed, five, seven and ten miles an hour, all of which were very successful. There were on the car Prof. Kohl, the electrician; Secretary Bamhoff; Michael O'Brien, superintendent of the Fourteenth Street Blue Line; Mr. Smith, Mr. Cameron, of the Lindell Line, and a number of conductors and drivers, all of whom were highly pleased.

PERSONALS.

Mr. Elias Smith, an old journalist, and one of the men who helped to organize the Associated Press, died last week at Livingston Manor, 72 years old.

Dr. Tyndall.—In retiring from the Chair of Natural Philosophy at the Royal Institution, says the London *Electrical Review*, Professor Tyndall has refused anything in the nature of a retiring allowance. He is to be made an Honorary Professor of the Institution, and a course of lectures bearing his name is to be established. His bust in marble will be subscribed for by the members

and it will be placed in near association with the statue of his friend, Faraday. Professor Tyndall is understood to be in comfortable circumstances, and his health shows signs of improvement. The successor of Professor Tyndall has not yet been appointed, but Lord Rayleigh has been nominated.

Dr. Henry Randolph Waite, of Boston, has become the secretary of the Julien Electric Company. Dr. Waite, who is a relative of Chief Justice Waite, was the President of the Institute of American Civics and editor of the *International Review*. Mr. Salom still remains in the directorate of the company, but will devote himself entirely to the expert work.

Prof. S. F. B. Morse.—At the sale of pictures from the Fearing and other estates in this city, on April 28, a landscape by Prof. Morse was put up. It is said to be an undoubted Morse, but is in no way meritorious as a picture. The sale was slimly attended and the picture was bought for $22½ by a Mr. Clarke, well known here as a purchaser of early American canvases.

MISCELLANEOUS NOTES.

Chicago, Ill.—The Central Electric Company, of Chicago, has been incorporated by M. T. Greene and others with a capital stock of $10,000.

Manufacturing in Jersey.—The New Jersey Electric Company, of Camden, N. J., has been incorporated by W. G. Meyers and others with a capital stock of $100,000.

Storage Battery Literature is accumulating with the growth of litigation. The last pamphlet to reach us is one issued by the Julien Company addressed to its customers and explaining its stand and status with regard to the suits now being brought against it. Accompanying the pamphlet is a copy of M. Julien's patent 347,300, claiming an inoxidizable support plate, etc.

Fire Alarms in Hotels.—It is not unnatural that the work of the electric fire alarm in saving life at the fire in the Richmond Hotel, Buffalo, should be attracting the notice of hotel men, and that the press should be insisting on the universal use of such alarms in the big hotels. The evidence obtained at Buffalo, in the inquiry, shows that the Hess system of fire calls in use at the hotel, prevented the loss of life from being anything like what it might have been. This system, which rings in every room violently and most effectively, is made by the well-known Standard Electrical Works, of Cincinnati.

An Electric Air Brake.—A special dispatch of April 28 from Kankakee says: Mr. Carpenter, of Berlin, Germany, made a trial trip yesterday with a train of thirty Illinois Central freight cars supplied with his air brake, the valves of which are worked by electricity. The run was over the Illinois Central track from Chicago to Kankakee and return. The dynamo is carried on the left side of the locomotive. The instantaneous setting and unsetting of the brakes was perfect. The inventor supervised the building of the train at the Illinois Central works, Chicago. This was the first trial of the invention in America, though it is widely used in Germany. The train is being prepared for trial by the committeee of railroad men at Burlington, Ia., on May 9, who will test the various makes of brakes.

BUSINESS NOTICES.

Steam Engines.—Special attention is called to the illustrated advertisement of the New York Safety Steam Power Co., on page xx.

Wire for Sale.—The Standard Electric Clock Co., 62 Reade street, has 11 miles of No. 14 K K wire for sale at half price. Good reasons for selling.

For Cleaning and Polishing Arc-Light Globes and Incandescent Shades Nothing Equals "Silk Sponge Pads."—This novel and handy cleanser and polisher is made of silk waste. It removes grease, dirt or stains from glass and other smooth surfaces quickly, economically and effectively. By the highly-polished condition of electric light globes or shades, result ing from the use of the "SILK SPONGE PAD," the full benefit of the light is obtained. Several electric light companies now use the pad. The price is $4.50 per dozen, and may be obtained from all electrical supply dealers, or of George S. Brown, 2,290 Washington street, Boston, Mass.

The Universal Radial Drill Company, Cincinnati, O. have issued a catalogue of the "Universal Radial" and "Radial" drills, and cite in it a number of testimonials. Among the users is the Schuyler Company, Hartford, Conn.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, membe New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

May 4, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	35
Am. Tel. & Cable	75	77
Cen. & So. Am.	96	100
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	80	82
Pac. & Atl.	48	54
*Postal T. & C.	.....	.....
South. & Atl.	65	.....
W. U. Tel.	75⅝	75½
W. U. Scrip.	75	.....
W. U. Bonds	116½	.....
Mut. U. Bonds	85½	.....
TELEPHONE.		
Am. Bell	220	222
Am. Speaking	110	120
Erie	28½	29
*Hudson River	.....	58½

TELEPHONE.	Bid.	Asked.
Mexican	1¾	1⅞
*N. Y. & N. J.	87	91
N. Y. & Pa.	.....	.....
New England	44	44½
*Southern Bell	120	135
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	230	235
*Edison Ill	95	105
*Edison Isolated	.....	.....
*United States	40	.....
*U. S. Ill	90	95
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

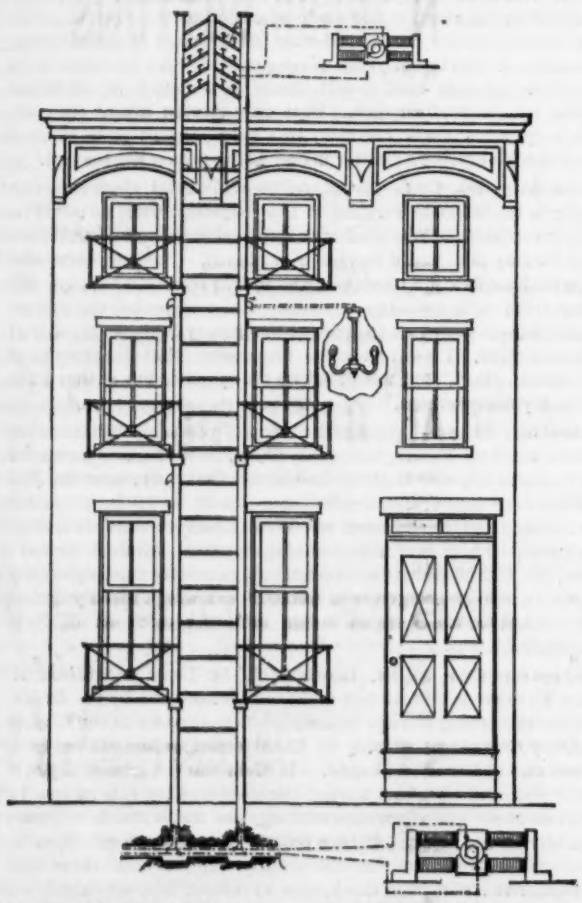
* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 19, 1887.

361,265. Branch Conduit for Electrical Conductors; Josiah M. Clokey, Decatur, Ill. Application filed May 1, 1886. This is a tubular frame work which is usually placed against the face of houses. It carries electrical conductors and is provided with branching sections by means of which the conductors may be led off to supply the several floors of a building. The invention also embraces bridging frames, which extend across streets and over passageways which may be used for suspending arc lamps. The form of the device is that of a ladder, so that it may be used as a fire escape when it becomes necessary. See illustration.

361,270. Automatic Electric Damper Regulator; E. N. Dickerson, Jr., of New York, N. Y. Application filed Feb. 27, 1885. The dampers are operated directly by water pressure and the water valves are controlled by a current of electricity, operated by thermostats.



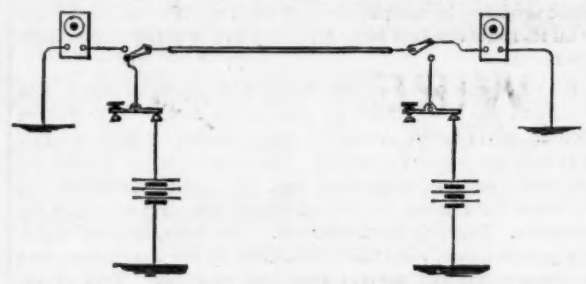
361,265. BRANCH CONDUIT FOR ELECTRICAL CONDUCTORS.

361,273. Fusible Connection for Armatures of Electric Generators; James W. Easton, New York, N. Y. Application filed April 13, 1886. Each joint between the bobbins is connected with its commutator plate by a fusible connection, which, while normally conveying the currents produced by the generator without developing heat, will be fused by an excess of current. See illustration.

361,274. Electric Motor; J. W. Easton, of New York, N. Y. Application filed July 3, 1886. The object of this invention is to construct a motor so that the points of magnetic polarization of the armature shall be so located as to be acted upon by the field magnets to the best possible mechanical advantage.

361,275. Electric Signal for Weighing Scales; E. S. Enyart, Ottawa, Ill. Application filed Sept. 2, 1886. This is an apparatus attached to weighing scales whereby an alarm may be rung at a distance from the scale when the correct weight is registered. The device will also notify whether the weight registered is the correct one or not.

361,276. Subway for Electric Current Wires or Cables; J. MacFarlane, of Malden, Mass. Application filed Oct. 21, 1886. This conduit is a tubular structure, made in sections and provided with segmental saddles or brackets for supporting the cables. The conduit is formed by winding spirally strips of wood or similar material.

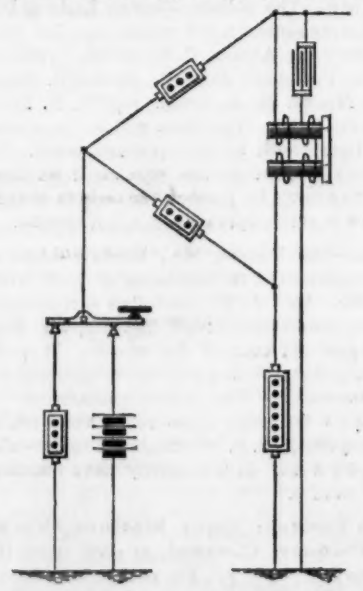


361,498. SIGNALING THROUGH SUBMARINE CABLES.

361,302. Mechanical Telephone Line Hanger; G. W. Lord, of Boston, Mass., Assignor by mesne assignments to the Lord Acoustic Telephone Manufacturing Company, of Maine. Application filed Nov. 5, 1885. These hangers consist of tubes provided with loops on the inside through which the line passes.

361,319. Underground Conduit; I. Paxon, of New York, N. Y. Application filed Jan. 19, 1887. The idea is to increase facility in laying and repairing the conduits.

361,356. Duplex Telegraphy; G. W. Gardanier, of New York, N. Y., Assignor to the Baltimore & Ohio Telegraph Company, of Baltimore, Maryland. Application filed Sept. 23, 1885. The invention relates to the organization of circuits and apparatus for preventing the false signals which are liable to be produced upon the receiving instruments at the home stations of duplex and quadruplex telegraphs by reason of the momentary currents due to the static induction of the main line. See illustration.



361,356. DUPLEX TELEGRAPHY.

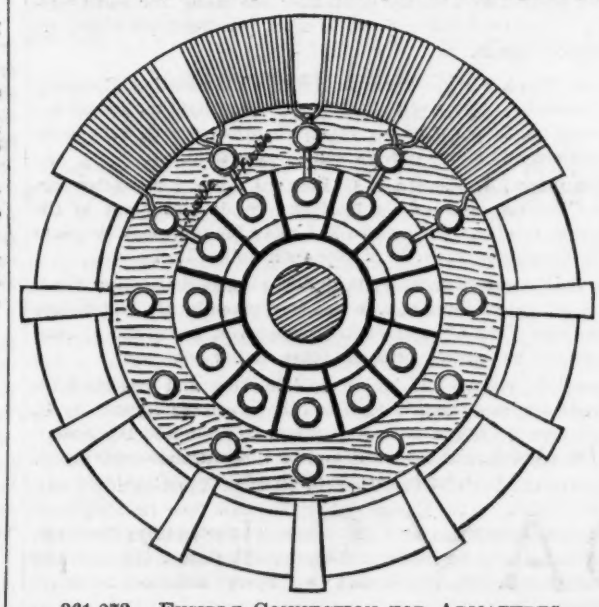
361,364. Duplex Telegraph; J. W. Larish, of Buffalo, N. Y., and W. Maver, Jr., of Jersey City, N. J., Assignors to the Baltimore & Ohio Telegraph Co., of Baltimore, Md. Application filed July 3, 1886. The object is to provide means for neutralizing the effect upon the differential receiving-instruments usually employed in such systems, of the static charge and discharge, which takes place upon connecting and disconnecting the transmitting-batteries with line.

361,365. Calling Apparatus for Telegraph Circuits; J. W. Larish, of Buffalo, N. Y., Assignor to the Baltimore & Ohio Telegraph Co., of Baltimore, Md. This is a signaling apparatus whereby an operator may call a distant station without calling upon the main office at the home station. Harmonic instruments are used for the purpose.

361,455. Safety Lamp for use in Mines and other Places; M. Settle, of Snow Hill, Darcy Lever, near Bolton, County of Lancaster, Eng. Application filed Sept. 8, 1886. This relates to lamps inclosed in water jackets, and means are provided whereby on the leakage of the water a float breaks the circuit and the lamp is extinguished.

361,481. Telephone; C. S. Bell, of Columbus, Ohio. Application filed Oct. 2, 1886. This is a novel arrangement of multipolar magnet for telephones.

361,498. Method of and Apparatus for Signaling Through Submarine Cables; Moses G. Farmer, of Eliot, Maine. Application filed Dec. 13, 1886. This is a method of signaling through circuits of high electrostatic capacity, such as submarine cables, which consists in abruptly changing the electrical condition of the cable circuit and utilizing the initial effect immediately attendant upon such changes to produce at the opposite or receiving end of the cable sounds or audible signals in a telephone. See illustration.



361,273. FUSIBLE CONNECTION FOR ARMATURES.

361,499. Mechanical Telephone; M. Garl, of Akron, Ohio. Application filed March 24, 1886. Strength and durability of the instrument, and strong sounds are the objects of this invention.

361,511. Combined Clock and Alarm for Hotels, etc.; Arthur B. Harford, of East Saginaw, Michigan. Application filed Jan. 16, 1886. An alarm may be automatically rung to call guests by setting a clock by means of this mechanism at any time previous to the time at which it is desired the alarm should ring.

361,520. Lightning Rod; Charles F. Hill, of Hazleton, Penn. Application filed May 28, 1885. This is a hollow sectional rod carrying within itself a copper conductor. Means are also provided for keeping the earth moist around the foot of the rod.

361,587. Electrical Induction Apparatus; M. H. Gross, of York, Penn. Application filed July 21, 1886. A medical appliance whereby the strength of current given to a patient may be quickly regulated.

361,663. Electric Arc Lamp; G. A. Wiese, of San Francisco, Cal. Application filed Nov. 27, 1886. Improvements in the feeding of the carbon electrodes.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.

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A Practical, Experienced Plater; one who also understands close plating preferred. Address, with reference,

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To purchase one or two No. 8 Brush dynamos, also about 50 arc lamps, either single or double. Address, stating prices and particulars,

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A responsible party to take the agency for Chicago of an Electric Light Manufacturing Company. The agency has been established five years, and is represented by about 3,000 lights in the West. Only business answers will be noticed. Address

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Electrical Apparatus
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Supplies of Every Description.
Send for Catalogue.
Special attention given mail orders.

Battery Circuit Breaker,

For protecting gas-lighting, and other large batteries. No clock-work. Sensitive in operation. Never requires attention. *Low Price.*
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LATHES ON TRIAL.
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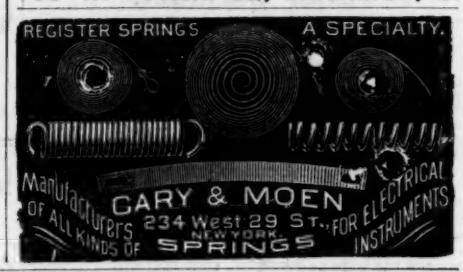

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Insulation Guaranteed Wherever Used Aerial, Underground or Submarine.

In a letter from the INSPECTOR of the **Boston Fire Underwriters' Union,** under date of March 29, 1886, he says: **"A Thoroughly Reliable and Desirable Wire in Every Respect."**

The rubber used in insulating our wires and cables is specially chemically prepared, and *is guaranteed to be waterproof*, and *will not deterioriate, oxidize* or *crack*, and will remain flexible in extreme cold weather, and not affected by heat. The insulation is protected from mechanical injury by one or more braids and the whole slicked with Clark's Patent Compound, which is water, oil, acid and, to a very great extent, fire proof. *Our insulation will prove durable when all other fail.* We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph, Telephone and Electric Light, from stock. Cables made to order.

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A CENTURY OF ELECTRICITY.

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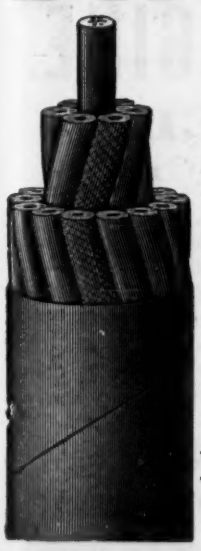

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WIRES AND CABLES,
For Telephone, Telegraph and Electric Light Use, and Electrical Circuits Generally.

The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short lived when placed either in the air or under ground, and the supposed new insulating compounds now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

The attention of **Telephone Managers** *is especially asked to our* **Anti-Induction** *Telephone cables, they being the most practicable and durable in the market.*

Telephone, Telegraph *and* **Electric Light Wires,** *for either* **submarine** *or* **underground** *work, a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.*

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EMPIRE CITY ELECTRIC CO.,

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MANUFACTURERS OF AND DEALERS IN

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TELEGRAPH "
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OUR SPECIALTIES ARE OUR EXCELSIOR

IRON AND WOOD BOX BELLS

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All of our own make and guaranteed the best in the market.

BRONZE AND WOODEN PUSH-BUTTONS

In 12 Different Woods and 6 Styles of Bronzes.

These Buttons cannot be excelled for style or finish; prices quoted for any quantity.

We make a specialty of fitting out Electric Light Stations with Insulated Wires, Rubber Hooks, Plyers, Climbers, Cleats, Cross-Arms, Pins, Brackets, Rubber Tubing and

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Insulators of all kinds, for which we are Headquarters.

EXCELSIOR MEDICAL BATTERIES

Are all Nickel finished, fine Black Walnut Cases, Inlaid Corners, with Sponges and Electrodes. Prices on application.

We are manufacturing

LEARNERS' INSTRUMENTS

That for style and finish cannot be beat, and at a very low price. ☞ *When writing for price, please name quantity.* These instruments are wound to 20 ohms.

ZINCS!! ZINCS!! ZINCS!!

All kinds of **FIRE-ALARM, DISTRICT MESSENGER** and **ROD ZINCS.** We are rock bottom on these goods.

All kinds of **Electric Gas-Lighting Supplies, Frictional Machines, Spark Coils, Bead Chains,** etc.

INCANDESCENT LAMP CORD; FLEXIBLE TINSEL CORD for **MEDICAL BATTERIES;** a full line of **TELEPHONE CORDS.** These goods are all carried in stock and sold at net bottom prices.

We also carry a full line of **Telegraph Instruments;** also, **Test Instruments, Galvanometers, Rheostats, Voltmeters** and **Ammeters.**

SOLE MANUFACTURERS OF PORTABLE DYNAMO GAS-LIGHTER.

BEFORE ORDERING, WRITE TO US FOR PRICES.

THE EMPIRE CITY ELECTRIC CO.,

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THE HESS SYSTEM

THAT WAS BURNED IN A TERRIBLE HOTEL FIRE.

MANY LIVES WERE SAVED BY ITS NOBLE WORK.

THIS CUT REPRESENTS

THE HESS SYSTEM

That was in the Richmond House.

Patented Feb. 6, 1883, No 27 ,737.
Patented Oct. 13, 1883, No. 327,097.
Patented Nov. 13, 1883, No. 238,570.
Patented May 18, 1886, No. 341,909.
Re-issue, Patented April 13, 1886, No. 10,711.
Patented Oct. 12, 1886, No. 350,626.

HOTEL HORROR!

The Richmond House, Buffalo, Burned.

[SPECIAL DISPATCH TO THE ENQUIRER]

BUFFALO, March 18.—The Richmond Hotel burned early this morning, and it was one of the most terrible hotel fires that has occurred in several years.

William Alport, the Night Clerk, says: "The fire started in the cloak room, under the main stairway, at 3:05 o'clock. There was nobody up but myself, Joe, the night porter, and Plummer, the bell-boy. *I pulled all four of the fire-alarms on the different floors, and the people came flying down stairs in their night clothes.*"

LIVES SAVED BY THE BELLS.

Mr. Stafford, proprietor of the hotel, tells the following story: "Our room was on the south end, and we dropped down onto the roof of the frame building. *We were awakened by the electric bells, and if they had not been turned on promptly there would have been a terrible loss of life. The bells awakened everybody in the house.*"

C. G. Beggs, of New York, lies propped up on pillows at the Tifft House, his face black as coal. He told the following

GRAPHIC STORY OF ESCAPE:

"I was on the fourth floor in a room close to the elevator. *The first thing I heard was the electric bell.* I jumped up, pulled on my clothes and stockings, and opening the door leading into my friend Devine's room, awoke him."

OUR CLAIMS

FOR

THE HESS SYSTEM

FULLY SUSTAINED BY THE FIRE IN RICHMOND HOUSE.

Read carefully the extracts of newspaper items, taken from the leading newspapers of the country.

REMEMBER,

That our HESS SYSTEM of Gues Call and Fire-Alarm can be attached to the Electric Annunciator You now Have in Use.

DO NOT BE DECEIVED

By Cheap Electrical Devices, but investigate the merits of the system that is known to be reliable.

For full information and your own protection, please note carefully

THE DECISION OF OUR PATENT ATTORNEY.

The Hess Division of Batteries

IS WHAT MAKES THE FIRE-ALARM RELIABLE.

A THRILLING EXPERIENCE.

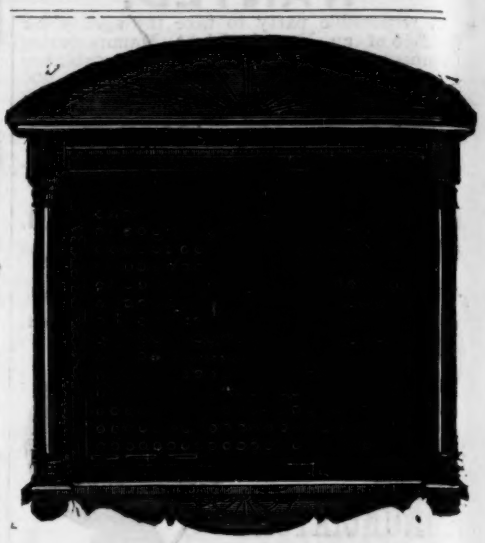
Mr. Wimpfheimer, representing the great printing ink house of Sigmund, Ullman & Co., of New York, was a guest at the Richmond, and with his wife occupied room 209, on the third floor.

Mr. Wimpfheimer said: "We had been to the theatre, my wife and I, and retired to our chamber about midnight. Everything was cosy and comfortable, and I was sleeping like a top, when suddenly *I was awakened by the jingling of the electric bell in our room. God bless the man who started the bell, who ever he may be, for he saved our lives.* I roused my wife and told her that that was a danger signal, and she had better follow me."

One thing is certain—*the electric fire-alarm worked well at the Richmond. The guests were aroused by the bell, though some of them did not know it was an alarm of fire. The system is known as the "Hess Electric Fire-Alarm," and its utility is acknowledged by Mr. Stafford and all who were in the hotel at the time of the fire.*

It was said that in the new Richmond there was a fire escape at the end of every hallway, but the interior court becoming rapidly filled with flame and smoke, it was impossible in every case to reach the end of the hall. *The electric fire-alarm did its work rapidly and effectively, and is credited with the saving of many lives.*

One of the most remarkable and thrilling experiences of those who escaped, was that of Mr. H. P. Whittaker, a member of the firm of Stafford & Co., proprietors of the hotel. *He occupied a room in the fifth story, and was awakened by the ringing of the electric bell, with which each room was connected with the office.*



GUEST CALL AND FIRE-ALARM ONLY.

CAN BE ATTACHED TO YOUR ANNUNCIATOR.

LETTER ABOUT THE HESS PATENTS.

CINCINNATI, O., June 1, 1886.

STANDARD ELECTRICAL WORKS:

Dear Sirs: At your request I have examined the Letters Patents of Albert T. Hess, No. 10,711, Hotel Annunciators and Fire-Alarms, and the claims of this patent are good, and any one putting up a Fire-Alarm and Annunciator, with a Guest Call, and using batteries in sections, are clearly infringers.

I have also, at your request, examined the Letters Patent of Albert T. Hess, No. 341,909—Electric Annunciator and Fire Alarm—and the claims of this patent are good.

Any one putting up an Electric Guest Call, or an Electric Guest Call and Fire-Alarm combined with an Annunciator, and using for the purpose of operating same a double contact circuit closer in the rooms and office, and working two or more distinct batteries, infringes this Letter Patent.

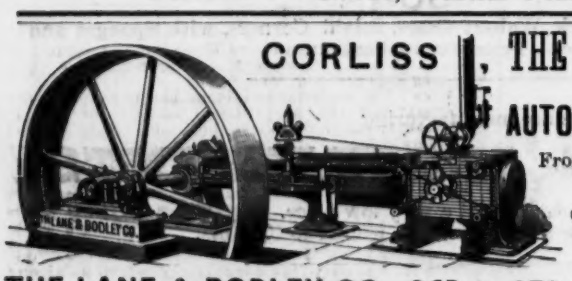
Yours truly,
JEPTHA GARRARD,
ATTORNEY.

SEND FOR ESTIMATES AND DESCRIPTIVE MATTER TO

STANDARD ELECTRICAL WORKS, SOLE MANUFACTURERS AND LICENSEES, 161, 163 & 165 W. Pearl St., Cincinnati, O.,

OR TO FOLLOWING TERRITORIAL AGENTS:

E. S. Greeley & Co., New York; Georgia Electrical Works, Atlanta, Ga.; Electrical Supply Co., Chicago, Ill.; O. W. Ditsch & Co., Kansas City, Mo.; G. V. Rice, Minneapolis, Minn.; Los Angeles Electrical Works, Los Angeles, Cal.; Julius Andrae, Milwaukee, Wis.; Viaduct Mfg. Co., Baltimore, Md.; J. W. Braid, Nashville, Tenn.; Sunset Telephone Co., San Francisco, Cal.; Schmidt, Kaelber & Co., Rochester, N. Y.; Central Pennsylvania Telephone Co., Williamsport, Pa.; Ernest Axthelm, Pittsburgh, Pa.



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ESTIMATES FURNISHED ON APPLICATION.

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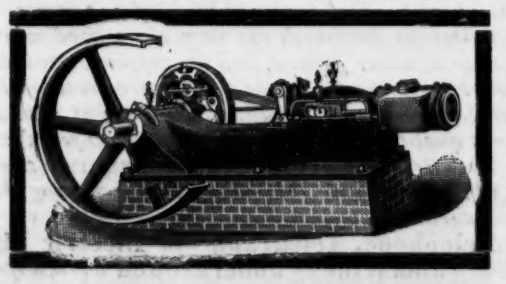
THE ONLY ENGINE WHICH DID NOT STOP ITS LIGHTS AT CINCINNATI, 1884.



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Awarded GOLD MEDAL at Cincinnati, 1884.

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